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The
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No. 1. JULY, 1904. Vol. XXIV.

ADDRESS TO THE ROYAL GEOGRAPHICAL SOCIETY, 1904.*

By Sir CLEMENTS R. MARKHAM, K.C.B., F.R.S., President.

The great event of the year has been the completion of the work of our Antarctic Expedition. This is not only the most difficult and important work ever undertaken by our Society, but it is also the most successful. I propose to refer to this grand achievement at the close of my address; and in the meanwhile to place before my colleagues the activities of our Council, and the results of exploring work in other parts of the world.

But first let me remind you that we have to lament the loss of one of the few remaining pioneer explorers of Africa, one who did more than any other probably to fill the blank in Central Africa which disfigured the maps of thirty years ago. The name of Henry Stanley will ever be associated with that of Livingstone, and with that great river Congo which forms one of the most striking features on the map of Africa. From beginning to end he made a broad and deep mark on the Dark Continent; he was the first explorer to receive from this Society the recognition of a second medal.

One other death which has occurred since last I addressed you, is that of one closely connected with the work and the welfare of the Society for many years—the Hon. George Brodrick, Warden of Merton College, Oxford. His tenure of office as Vice-President and Councillor was a long one, and his judicial mind and practical common sense proved repeatedly of the greatest service when difficulties arose.

In my last address I brought to your notice, and asked your special attention to, our own urgent needs as regards house accommodation. The Council have had the question under serious consideration. The

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* Read at the Anniversary Meeting, May 16, 1904.

Society continues to increase and to prosper, its numbers having reached to 4280, and the income increases proportionately. At the same time the work of the Society has so increased during the thirty years that it has occupied the present premises, that they have become much too small for its requirements. Every department of the Society is more or less congested. But the value of property has more than doubled in the last ten years. A handsome price has been offered for our house, but in addition to that sum a further large sum would be required to obtain a freehold site and erect a building worthy of the Society, suitable for its present requirements, and leaving room for expansion in the future. Several suitable sites have been offered; but to borrow the sum required would involve the Society in an extra annual expenditure, so large that the Council do not feel justified in taking any practical steps unless the bulk of the amount required, about £120,000, is subscribed either by the Fellows, or by one or more benefactors who may be convinced that our Society is rendering eminent public services. Meantime the Special Committee appointed for the purpose is to reconsider the whole question of increased accommodation, with a view of finding a solution of a practical character.

I pass from this momentous question of a new house, so difficult of satisfactory solution, to the Society's educational efforts, and here there is every reason to be satisfied with the progress that has been made during the past year. The syllabus for instruction in geography in elementary and in secondary schools, drawn up by the Society, to which I alluded in my last two annual addresses, has been widely distributed, and much sought after by teachers all over the country, in our colonies, and abroad. There is every reason to believe that the result will be one more step towards the improvement of geographical teaching. The new standard of geography aimed at in the London University Matriculation examination has also had its effect, and the results are becoming more and more satisfactory. I consider it a matter of great moment from our point of view that the directorship of the London School of Economics should have been entrusted to the Reader in Geography at Oxford, Mr. Mackinder. It is one more proof that the importance of geography, not only as a science, but in the practical affairs of men, is becoming increasingly recognized.

Fortunately, Mr. Mackinder's appointment to the School of Economics has not necessitated his retirement from his position at Oxford. The success of the Oxford School is largely due to him, and I think it would have been a misfortune if, at the present stage, it should have been deprived of his superintendence. So satisfied are the Council with the progress that has been made at Oxford under Mr. Mackinder and the other members of the staff, that they have felt justified in renewing the Society's annual grant for another five years.

In my last address I hinted that we had reason to expect that a new departure would shortly be taken as regards the position of geography at Cambridge. That university has been more hampered for want of funds than has been the case with the sister university of Oxford. This has, to a considerable extent, affected the position of geography at Cambridge. It has hitherto obliged the Reader, Mr. Yule Oldham, to work single-handed. The third term of five years, for which the Society's grant had been continued, came to an end last June, and the question of its renewal had to be considered. I am glad to say that the Cambridge authorities showed themselves really anxious to meet the Society's views as to the position that geography should hold among the university studies. It has been decided to establish a Board of Geographical Studies, on which the Society will be represented, and to increase the annual grant to geography by the university from £50 to £200. The staff of the new geographical school at Cambridge will consist, instead of one Reader, of several lecturers and teachers, who will cover the various departments of the science. A diploma in geography will be granted as at Oxford. But Cambridge goes a step further than Oxford, by introducing geography into the examination for the B.A. degree. The importance of according geography such a position in the studies of the universities must be evident to all, and must be specially gratifying to those who, for over thirty years, have fought hard, amid much discouragement, to have geography recognized as a university subject. It will be interesting to see how the Board of Geographical Studies at Cambridge will draw up the detailed regulations for the degree and the diploma, what steps will be taken to secure a competent staff to cover the whole field of our science, and especially to train young university men for practical work in the field. We have every reason to expect that the results will prove satisfactory.

A word must be said in recognition of the valuable work being done by the Geographical Association of Teachers, under the presidency of Mr. Douglas Freshfield, with Dr. Herbertson as secretary. It is doing much to enlighten teachers with regard to the capabilities of the subject, to raise its standard, and to introduce improved methods of teaching. During the year an interesting and useful conference was held at the Chelsea Polytechnic, under the auspices of this Association, and in connection with the Conference there was an excellent exhibition of appliances used in teaching geography, the usefulness of which was increased by sending it to various provincial centres. Altogether, then, it may be said that the educational movement, as regards geography, is expanding in all directions and on satisfactory lines.

During the past year the instruction in surveying and practical astronomy has been carried on by Mr. Reeves with marked success, and altogether sixty students have passed through his hands. Although most of these could only spare time for the more elementary work, yet twelve have gone through the complete course, and have obtained the Society's diploma after passing an examination before the Diploma Committee. This number of successful candidates is considerably in excess of any previous year, and is a clear indication of the increasing interest in the subjects that are taught, as well as of the thoroughness and practical nature of the instruction given. Most of those who have received our Diploma, during the past year, are already holding important positions as geographical surveyors in various parts of the world. Altogether this course of instruction given by Mr. Reeves must be considered a most important department of the Society's work, and one that is yielding excellent results.

In my last address I explained how my scheme for afternoon meetings on technical subjects, which was commenced in 1894, had been developed into a regular department of the Society's work, directed by a Research Committee, whose members are taken from the List of Referees. During the present session the Research Department has held several meetings, when matters of much scientific interest were considered and discussed. One important investigation has been initiated, namely, the changes which have taken place in the river-courses and on the north sea-coast region of England during the historical period, an investigation involving varied minute research, but sure to yield interesting results.

At one of the meetings a most interesting discussion took place on the question of the desiccation of Central Asia, introduced by Prince Kropotkin; at another there was a discussion on suggestions for systematizing geography, made by Dr. Herbertson. Sir John Murray, and several members of his staff engaged in sounding the Scotch lakes, gave the results of investigations of various phenomena in Loch Ness. At the suggestion of Mr. Francis Galton, a small committee has been appointed to consider the construction of perspective maps on scientific principles. Dr. Mill has brought before the committee a new system of nomenclature for the physical features of England and Wales. The proposed names have been carefully considered by a special committee, and, although difficulties have arisen, we hope soon to be able to publish a physical map of England and Wales, with all the great features suitably named. Another interesting contrivance brought before the committee was a flat model which solves problems in the use of the globes, by Prof. Everett.

Such are some of the directions in which the Research Department has been working during the year. One result has been to show that geography is as much adapted to be an implement of research as any other department of science.

The International Geographical Congress, which we passed on to our friends at Berlin in 1899, will this year be undertaken by our American cousins at Washington, to whom we confidently wish all possible success. At the special request of the Organizing Committee, this Society will be represented by ten delegates. As the Congress will meet at New York, Philadelphia, and St. Louis, as well as at Washington, it is likely to be one of special interest.

I pass now to the main features of the exploring work of the year. It was with great regret that we heard of the loss of our valued associate Baron Toll and his companions. They had undertaken to discover and explore any land to the north of the New Siberia Islands; but they have long been missing. Diligent search will be made in every likely quarter, but it is to be feared that little hope can be entertained. Baron Toll was an able and accomplished scientific explorer, and had been at work on the Siberian coasts and seas, at intervals, for over twenty years. We sympathize with our Russian colleagues in the loss of this eminent geographer. Many also, in this country, who knew Admiral Makaroff, the inventor of the ice-breaker which he himself tried in the Arctic Regions, will regret that the fortune of war has led to the loss of an accomplished naval officer, an able inventor, and a genial friend.

The great geographical interest of the year, as regards Asia, centres in the mysterious land of Tibet. Prevented from free access to the country of the lamas, it has been the business of this Society and of the kindred Hakluyt Society to collect and arrange all previous information for the use of explorers who would penetrate into the country in the fulness of time. Sir Henry Yule, in his valuable work 'Cathay and the Way thither,' published by the Hakluyt Society in 1866, made known to us the journeys of Friar Odoric of Pordenone, the first visitor to Lhasa. I am happy to be able to announce that M. Cordier, the President of the French Geographical Society, has consented to prepare for us a second edition of 'Cathay and the Way thither,' which has long been out of print. We shall have the pleasure of welcoming M. Cordier this evening.

Our subsequent knowledge, down to the middle of the last century, was based on the maps drawn by two lamas who had received instruction from the Jesuit Father Regis at Peking. These maps were finished in 1717, and published by Du Halde. They can be consulted in our map-room. To this day the lama survey is the basis of our geographical knowledge, with corrections by the pundits of the Indian Survey Department and others.

It was due to the enlightened policy of Warren Hastings that friendly relations with Tibet were established, but his able and intelligent envoys were not surveyors. In 1875 I was entrusted with manuscripts of Mr. Bogle, the envoy of Warren Hastings, and of Mr. Manning, the only Englishman who has ever visited Lhasa, with a view to publication. The result was my volume entitled 'Missions to Tibet,' which contains the narratives of Bogle and Manning. In an introduction I brought all existing information together down to 1875, and there was a second edition in 1879. My great object was to supply information which would be useful when the wise policy of Warren

Hastings was resumed. In 1885 there was an intention of sending a mission to Tibet under Mr. Colman Macaulay, with whom I corresponded until the intention was unaccountably abandoned.

In my address of 1896 I drew attention to the importance of exploring the great northern range of the Himalaya from Kailas to the Goring-la of Littledale, and I got together all available information on the subject. But this is work which still remains to be done. The Society's last contribution to a knowledge of Tibet has been the publication of the journey to Lhasa and Central Tibet by Sarat Chandra Das, edited by the Hon. W. W. Rockhill.

Meanwhile the Imperial Russian Geographical Society has been more successful in collecting information. Mr. Oldenbourg, of the Academy of Science of St. Petersburg, and our colleague Mr. Gregorief, have prepared a list of all the travellers who have described Lhasa, and a bibliography of their works. There are upwards of twenty. The literature of Tibet itself has received attention from our Russian colleagues. The Buriat Lama Tsibikoff, who has taken a degree with honours at the university of St. Petersburg, was sent to Lhasa, commissioned by the Imperial Russian Geographical Society, and recently returned to St. Petersburg, bringing back descriptions of the route and of the Tibetan capital, and a library of Tibetan books in 319 volumes, containing 122,000 sheets of printed matter, including Tibetan history, geography, astronomy, astrology, magics, and religious works of the most renowned lamas of the last nine centuries. These books were printed at Lhasa from old wood blocks.

A series of fifty photographs were also taken in 1900 and 1901, on behalf of the Imperial Geographical Society, by M. Oushe Norzunoff, a Calmuck of the Astrakhan Horde, and M. Tsibikoff, a Kori Buriat already mentioned. They include views of the palace of Potala, of Lhasa, of the great monasteries, of Gyantse and Teshu Lumbo, of the Kichu—the river of Lhasa, and of the Yamdok or Palti lake. M. Semenoff has presented us with a complete set of these photographs, with a descriptive list in English by M. Gregorieff, for which we have returned our most cordial thanks for the great courtesy and kindness of our Russian colleagues. The photographs cannot fail to be of great interest to the Fellows of this Society.

At length, in the fulness of time, a mission, with an escort, has been sent to Tibet by Lord Curzon of Kedleston; and the wise measure of Warren Hastings has been resumed by the ablest of his successors. Our Gold Medallist, Colonel Younghusband, has received charge of the mission. It is a great pleasure to me to hear from our colleague that my book—'Missions to Tibet'—is useful, and that two copies of it are with the mission. The mission, with its military escort, has already gone over much interesting ground, and has nearly reached the Yamdok lake. Colonel Younghusband tells me that neither people nor country have altered since the days of Bogle and Manning, except that now the Chinese have less power. The mission is accompanied by two excellent surveyors—Captain Ryder, R.E., and Captain Cowie, R.E., and good surveying work has already been done, and will continue to be done. We shall have a really good map of all the ground traversed by the mission; and we must earnestly trust that Lhasa, with the valley of the Kichu, and all the upper valley of the Tsanpu, will be included. It was most desirable that the leader of a mission of such vast importance should be a geographer as well as a diplomatist, and no better qualified officer for such a service could be found than our Gold Medallist, Colonel Younghusband.

The Society has received from Dr. Merzbacher, the distinguished Central Asian explorer, a long preliminary account of his two years' exploration of the Tian Shan region, which will be published in the *Journal*, and is of great geographical interest.

We have also received an account of an expedition into Eastern Tibet, partly supported by the Society, by two young officers, Captains Rawling and Hargreaves, who have done some excellent surveying work.

In Africa the most important work of the year has been done by Captain Lenfant, whom we were glad to welcome on the shores of England, on his return from Nigeria. Captain Lenfant was well known before for the excellent work he did on the Niger. During his last expedition he practically solved the important hydrographical problem of the exact relations between the tributaries of the Benue and the Shari, which flows into Lake Chad. He has shown that, at certain seasons at least, it would be possible to go by water from the Atlantic, up the Niger and Benue, and down the Shari to Lake Chad. He, and other French officers, have made important contributions to our knowledge of the conformation and *régime* of that curious lake. Another French explorer, M. Chevalier, has just returned after doing much good work at the source of the Shari, and on the borders of Darfur and Wadai.

Two delimitation commissions have been at work in the Nigeria region, which have no doubt contributed considerably to a more precise knowledge of the country through which they have passed. In one of these, dealing with the Anglo-French boundary, Colonel Elliot was the leader of the British party, and we hope to hear from him, at an early date, some of the results of his operations. On the other side the Anglo-German Commission has been working out the boundary between the two spheres, and we may hope that the British officer on that commission, Colonel Jackson, now on his way home, will also favour the Society with an account of some of the geographical results of that expedition. In the same region a well-equipped party, with instruments furnished by the Society, has recently started on a two years' exploration. It is under the leadership of Lieut. Boyd Alexander, who proposes to proceed eastwards, mapping, observing, and collecting as he goes. Very important and varied results may be expected. On the eastern side of Africa, Major Delmé Radcliffe, the British representative in the expedition to delimit the boundary between the British and German territory west of Victoria Nyanza, has completed his work, and is now, I believe, carrying on further delimitations to the east of the lake.

All these labours are bound to lead to important contributions to a more exact knowledge of the geography of Africa. During the session we have had from Captain Maud some valuable information respecting the country traversed by him on Mr. Butter's expedition along the southern borders of Abyssinia. Other similar expeditions are at work on the Anglo-Portuguese boundary to the north of the Zambesi and elsewhere; while the great geodetic expedition through Central Africa is actively pursuing its important enterprise. Thus in time we shall have a series of trustworthy astronomically observed points which will enable us to map the interior of Africa with much more precision than has hitherto been the case.

In South America very important geographical work has been achieved under the direction of their Committee of Fluvial Highways by the Peruvian Government, and by the Arbitration Commission in the Patagonian Andes. Accounts have been given in our *Journal*, from time to time, of the activity of the Bolivians in exploring the more navigable courses of the tributaries of the great river Beni. But there remained some of the upper courses, especially of the Tambopata and Ynambari, which were unexplored. These have now been discovered and mapped by expeditions led by Villalta, Cipriani, and others whose work is exceedingly meritorious. The region is one of exceptional interest, because it contains those historical valleys on the eastern slopes of the Andes which are connected, by many ties and many reminiscences, with Cuzco, the sacred city of the Incas. It is one of vast importance, because it leads to a most valuable India rubber yielding region of immense extent. Colonel Church has contributed a very able and complete narrative of this Peruvian exploring work to the May number of our *Journal*, which will be found to be well worth careful perusal.

Since the last anniversary meeting, the work of the British arbitration commission appointed to demarcate the boundary, which had been the subject of a long-standing dispute between the South American republics of Argentina and Chile, has concluded its work. It will be remembered that early in 1902 one of our Vice-Presidents, Sir Thomas Holdich, with a party of officers who all had trained experience as surveyors, and who were all Fellows of this Society, was deputed, as a member of the Arbitration Tribunal, to examine into the geographical condition of the southern Andine country in Patagonia, in order to determine certain facts which bore closely on the solution of the difficult problems which beset the principles of arbitration as laid down in the treaties between the two states. Within the short space of a few months, in the autumn season in those southern regions, the examination of the coast configuration of Chile, and of the structure of the great mountain mass through which many of the chief rivers of Patagonia make their way to the Pacific, was successfully accomplished.

The evidence thus obtained was laid before the Arbitration Tribunal, and proved to be a sufficient basis for framing an award, which was given by King Edward VII. in the course of the same year. At the joint request of the two governments concerned, the services of the same party were subsequently placed at their disposal for the demarcation of the boundary determined under the award. The boundary extends through about 900 miles of rough and only partially surveyed mountain territory, constituting the Andine region of the Patagonian lake districts. The demarcation was effected during the southern summer months of 1902 and 1903, but the final maps and results were not submitted until last August, when the last chapter in this long story of international dispute was happily closed. When we remember the long years of most dangerous unrest which the undetermined boundary produced, the drag which it put on the progress of commercial development in those two rising states, the enormous cost of those preparations in ships and war material which was necessitated by the constant fear of an outbreak of hostilities between them, and last, not least, the peril which hung over the vast financial interests possessed by England in South America, we may well congratulate ourselves that we, as a Society, have contributed our share towards the evolution of a good understanding and a peaceful issue to the negotiations, which appear to possess every chance of permanency.

Since that boundary has been laid down throughout its long extent, winding over the crests of rugged sierras, and plunging into depths of forest-girt depressions, here setting a barrier of snow-crested impassable mountains between the two states, there stretching across the undulating grass-covered moraines and terraces of a former system of glacial lakes, everywhere presenting a recognizable limit to the territories appertaining to either of them, we have heard nothing from the two republics of the south but assurances of intense satisfaction that the danger has passed. On either sides of the Andes the two governments have applied themselves with earnest determination to the development of the vast natural resources which seem to be the heritage of all South America. Much geographical information of absorbing interest has been added to the store of the world's knowledge. The scientific leaders of thought and action have been brought into closer communion. That mutual bond of sympathy which is never wanting between geographers of all countries has been strengthened.

We may reasonably hope that, extending far beyond the limits of geographical brotherhood, there is now, and always will be, a well-grounded assurance of international friendship between these great and rising republics of South America and ourselves. It is based on the successful issue of this appeal from them to the decision of our peace-loving king, and of his answer to that appeal.

In turning to our great work in the Antarctic Regions, we are at once reminded of the cordial co-operation of the Argentine Government and people. Our main object was geographical discovery and exploration; but magnetic observations held an important place among our objects, and arrangements were made for such a combination of observations over the southern hemisphere chiefly, as had never before been attempted. The plan arranged with the magnetic observatory at Potsdam had for its object to procure a series of synoptic charts which will allow of the variations in the magnetic condition of the whole Earth being traced in detail during a definite period, and so to provide the necessary basis from which alone the fundamental problems of terrestrial magnetism may be more clearly approached. The observations were to be made simultaneously over the entire globe, consisting of observations of the three elements at intervals of an hour on fixed term days; and detailed observations of the three elements during a specified hour on each term day. Forms and instructions, supplied from Potsdam, were translated and sent to the observatories. These were at Bombay, Mauritius, Christ Church in New Zealand, Melbourne, Falmouth, Kew, and on board the exploring ships.

While these details were in course of arrangement, my friend Don Francisco Moreno came to me and proposed that I, in concert with Baron Richthofen and the German Committee, should request the Argentine Government to establish another magnetic station. We were met with a cordial assent. It was resolved to establish an observatory at Año-nuevo Island, off Statan Island; and Lieut. Horacio Ballvé, an able and intelligent officer, was appointed to procure the instruments in Europe, and to take charge of it. Sir Thomas Holdich had the opportunity of visiting the Argentine magnetic station, and was struck with the thoroughly workmanlike efficiency of all the arrangements, the excellence of the instruments, and the devotion to duty evinced by those who were destined to spend many months of the year on a small and storm-swept island, far away from the amenities of civilization, on work of purely scientific investigation. Simultaneous observations over the world have never been undertaken on the same scale, and they will supplement, to a very important extent, the elaborate work on board the *Discovery*. In this magnetic work the German and English expeditions have been able to co-operate. We now have simultaneous observations on both sides of the south magnetic pole, and at no great distance from it, which will probably enable magneticians to fix its position with accuracy, while Captain Scott has crossed the line of no variation.

As regards Antarctic exploration, there have been three expeditions which have worked on the Antarctic circle and its neighbourhood; and one which has penetrated far to the south, to examine and solve the geographical problems of the Antarctic regions.

Dr. Nordenskiöld's enterprise, owing to his sojourn having extended over two complete years, and for other reasons, appears to have secured the most important results of the three expeditions which remained on the threshold of the unknown south. His discovery of a Jurassic and a Miocene fossil flora in the South Shetland Islands, and of fossil bones of mammals, possibly points to a connection of these islands and of Graham Island with South America. This discovery is the main result of Dr. Nordenskiöld's visit to the South Shetlands. He has recently given us a most interesting account of his expedition, and of the perils of the crew of his ship the *Antarctic*, owing to her loss in the ice. When Dr. Nordenskiöld did not return in 1902, it was feared that there had been some disaster, and the Argentine Government promptly and generously came to the rescue.

A year ago Lieut. Julian Irizar, a young Argentine naval officer, who was the naval *attaché* in London, came to me for advice, as he had been ordered to fit out and command a vessel to be sent for the relief of Dr. Nordenskiöld. We talked the matter over, and I put him in the hands of Mr. Ernest Shackleton and Mr. Cyril Longhurst, our Antarctic secretary, for there was no one in this country who knew so much about fitting out an Antarctic ship as they did. He also went to Norway, and got sledge equipment under the guidance of our associate, Mr. Crichton Somerville. Fully provided, he proceeded to Buenos Ayres, took command of the gunboat *Uruguay*, sailed in October, and by the middle of November he had picked up Dr. Nordenskiöld and his party on one island, the shipwrecked crew of the *Antarctica* on another, collections of fossils on another, and brought all safe back to Buenos Ayres. Lieut. Irizar's relief voyage was such a smart piece of work, and his narrative is so modest and straightforward, that I have translated it for the May number of our *Journal*. This gallant young officer of the Argentine navy has received to-day at our hands, the public recognition of his skill and enterprise in executing this rescue work so promptly and so well. The incident is perhaps significant of the position which the Argentine navy may hereafter assume amongst the navies of the world. Polar exploration is a noble ambition among naval men, and Argentina, in the persons of Irizar and Sobral, already boasts of Antarctic naval officers.

There is a very useful piece of Antarctic work to be done, which seems specially to belong to the Argentine Navy, namely, the circumnavigation or circumambulation of the southern half of Graham Island.

I trust that before very long an Argentine naval officer will be leading a well-equipped Argentine expedition to the southern extremity of Graham Island.

Mr. Bruce, as I anticipated in my address last year, found no land in the Weddell Sea north of the point reached by Sir James Ross in 1843. Mr. Bruce entered the pack on February 2, took several soundings, and found a uniform depth of 2500 fathoms, between 61° and 70° S. He wintered at the South Orkney Islands, and is now on his way back to Scotland.

Dr. Drygalski was so good as to come from Germany to give us an account of his expedition. Leaving Kerguelen Island in the end of January, the *Gauss* was steered eastward of south, but was stopped by land before crossing the Antarctic circle. This land consists of a volcanic hill named Gaussberg, and some ice-cliffs, the whole receiving the name of Kaiser Wilhelm Land. The *Gauss* wintered on a comparatively shallow bank about 50 miles north of Gaussberg, and it is considered that this was a specially favourable position for making biological collections. The meteorological series of observations will be valuable, and the magnetic observations, taken in co-operation with the other stations and with the English Expedition, have special value. When the ice broke up in the summer, the *Gauss* returned by way of the Cape.

Theorists seem to wish to connect Gaussberg with Kemp Land to the westward by a continuous coast-line; but the facts, so far as has been ascertained, are against them. The distance from the Gaussberg of Drygalski to Kemp Land is over 700 miles. The only vessel that has crossed the Antarctic circle on those meridians is the *Challenger* on February 16, 1874. She went 10 miles south of the circle, and was in 66° 40′ S. and 78° 22′ E. We learn from the *Challenger* narrative, that there was no pack-ice, a clear sky to the south, and that land of any elevation would have been seen at a distance of 50 or 60 miles. "To the eastward of the meridian of 92° E. icebergs were very numerous. Their absence further to the westward, between 70° and 80° E. long., except when close to the pack-edge, was so marked that, coupled with their absence on the same meridians in lower latitudes as shown by the ice-chart, it seems to indicate that there can be no land for a considerable distance south in that neighbourhood, and that a very high latitude could be gained there if desired."

This is conclusive so far as it goes, and points to one route by which the Antarctic Regions may be penetrated. I explained this in my "Plan of Operations." For our idea of Antarctic exploration was not to stop about the circle, but to force a way through the pack and penetrate far to the south, so as to learn the secrets of the vast unknown area. I looked upon the route pointed out in the *Challenger* narrative as the second best, and I thought that the German Expedition would take it.

The best route was to follow in the track of Sir James Ross, and to attempt the solution of the various geographical problems which were the outcome of his discoveries. The old sailing bomb ships did not enable Ross to approach the coast very closely, nor to land except on small islands. But he delineated the lofty mountain range which it was for another to explore; he saw the great active volcano which it was for his successor to examine; he reported the wonderful ice-barrier which others were, when the time was ripe, to land upon and explore, and he thought he saw signs of the eastward land which his successor was to discover.

Captain Scott's instructions were to achieve all these great and difficult services, and thus to crown and complete the work of his illustrious predecessor by facing greater hardships, by overcoming far more formidable obstacles, and by the endurance of a much longer period of Antarctic rigour. It is Scott's great merit that he not only carried out these instructions thoroughly and completely, but that he and his gallant companions have accomplished far more than was expected from them. It is my desire that all their names should be recorded here, for all have contributed to the great success.* Those of Ernest Shackleton, who so gallantly assisted Scott in his great southern journey until he broke down, and of William Macfarlane, who was also invalided, are fully remembered with the rest.

We must wait until the return of the expedition for a complete account of the work done, and of the conclusions derived from the scientific results. We have only received an outline—how, in the navigable season of 1902, the great ice-barrier was examined, its character investigated, and a line of soundings taken along its face; how King Edward VII. Land was discovered to the eastward; and how an excellent wintering-place was found as the base of subsequent operations on land. We know how invaluable observations were taken, and collections made during two long winters of darkness and hardships in 77° 50′ S. We know how the sledge parties achieved magnificent results during the two working seasons; how Scott himself, with two companions, reached a latitude of 82° 17′ S., and saw a mountain range extending to 83° S.; how exploration was systematically carried on by other sledge parties in various directions; how in the second season Scott made a journey into the interior for a distance of 270 miles, crossed the meridian of no variation, and discovered a fossil flora; how another party went south to 80° to examine a great inlet sighted during the previous season; and how a third party traversed the great barrier for 155 miles, examined its character, and took a uniform series of magnetic observations. We know how Captain Scott succeeded in getting the *Discovery* out of the ice, and that he did much more geographical work in his second navigable season before returning to Lyttelton. We further know that this magnificent tale of work could not have been achieved without rare qualities on the part of the leader, and zealous co-operation on the part of officers and men, as well as good fellowship among the whole gallant band.

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* *Captain*—Robert F. Scott, R.N., M.V.O., F.R.G.S.
Lieuts.—Albert B. Armitage, R.N.R.
Charles R. Royds, R.N., F.R.G.S.
Michael Barne, R.N.
Sub-Lieut.—George F. A. Mulock, R.N., F.R.G.S.
Eng.-Lieut.—Reginald Skelton, R.N.
Surgeons—Reginald Koettlitz.
Edward Wilson, M.B.
Physicist—Lewis C. Bernacchi, F.R.G.S.
Biologist—J. V. Hodgson.
Geologist—H. J. Ferrar.
Assistant Engineer—J. H. Dellbridge, R.N.
Boatswain—J. A. Feather, R.N.
Carpenter—F. C. Dailey, R.N.
Steward—C. R. Ford, R.N.
Petty Officers—Edgar Evans, R.N.
David S. Allen, R.N.
Jacob Cross, R.N.
Thomas Kennar, R.N.
William Smythe, R.N.
Stokers—Arthur E. Quartly, R.N.
William Lashly, R.N.
Thomas Whitfield, R.N.
Frank Plumley, R.N.
Able Seamen—Thomas Crean, R.N.
George B. Croucher, R.N.
James W. Dell, R.N.
Jesse Handsley, R.N.
W. L. Heald, R.N.
Herbert Joyce, R.N.
Arthur Pilbeam, R.N.
Frank Wild, R.N.
T. S. Williamson, R.N.
W. J. Weller.
Marines—Corporal Blissitt, R.M.
Private G. Scott, R.M.
Cook—J. Hancock.
Cook's Mate—Charles Clarke.

†

Able Seaman—George T. Vince, R.N.
Lost his life, March 11, 1902.

> "By mutual confidence and mutual aid,
> Great deeds were done and great discoveries made;
> The wise new prudence from the wise acquire,
> And one brave hero fans another's fire."

But we only know these things in bare outline. We await the return of our friends before we can hear the whole glorious story in detail.

I believe that the great success is due to the command being entrusted to a young naval officer in the regular line, supported by thirty naval officers and men, zealously devoted to duty, and resolved to uphold the credit of their noble profession in the far south. The navy assuredly has cause to be proud of their exploring detachment, which has been spared by the Admiralty for a most important service.

The Council resolved that Captain Scott had won the Patron's Medal for his memorable sledge journey to 82° 17′ S. alone, and his Majesty the King has approved the choice. Scott's equally important inland journey, during the second season, was not then known. It more than doubles the strength of his claim. But it was felt that these journeys only represent a fraction of our colleague's merits. His conduct of the expedition, the preservation of its well-being for so long a period under most trying circumstances, and his high qualities for command, deserved some special recognition. The Council has decided on presenting Captain Scott with a gold medal commemorative of the expedition, with replicas in silver for the officers and men.

The thanks of the two Societies are due to the Lords of the Admiralty. When I saw Mr. Goschen in November, 1896, he said that though the Government could not send an expedition, he assured me that the Lords of the Admiralty would take an interest in the enterprise, and would lend instruments. Their Lordships have ever since taken a great interest, have always considered our requests favourably, and have complied with them whenever it was possible. When, on April 6, 1900, Mr. Goschen promised to lend two excellent officers to the expedition, who proved to be Commander Scott and Lieut. Royds, I felt that success was secured. But the assistance from their Lordships did not end there. Commander Scott obtained from them almost everything he wanted, both as regards officers and men; so that now, out of thirty-eight, there are thirty naval officers and men on board the *Discovery*. To this the great success of the expedition is mainly due, and our most cordial thanks should be offered to the Lords of the Admiralty.

Next we are bound to offer the thanks of the Society to Captain Colbeck and his officers and crew, for the admirable way in which they have conducted the relief work. When, on September 18, 1901, in company with Captain Colbeck, I surveyed the *Morning* at Tonsberg, and concluded a bargain with her owner, I felt that we had secured the strongest ship and the best commander. His first voyage was by far the most important, because he then discovered the position of the *Discovery* and brought her relief. In the second voyage he knew the exact route to take. He conducted it with the same skill and judgment, while it was a much more open season. Besides his pre-eminence as an Antarctic ice-navigator, and his staunch loyalty to the expedition and to the Society, Captain Colbeck deserves great praise for his wise selection of officers, and for the respectability as well as zeal of his crew. The names should not be passed over, and I wish to record them in my address.* The Council has resolved to mark their appreciation of Captain Colbeck's excellent services by presenting him with a specially designed piece of plate. The good conduct of his crew reflects credit on the mercantile marine.

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* *Captain*—Lieut. William Colbeck, R.N.R., F.R.G.S.
Chief Officer—Rupert England.
Second Officer—Lieut. Edward R. G. Evans, R.N., F.R.G.S.
Third Officer—Gerald S. Doorly, R.N.R.
Mids.—Neville Pepper.
Maitland Somerville.
Engineer—J. O. Morrison.
Surgeon—G. A. Davidson, M.B.
Boatswain—A. Cheetham, R.N.R.
Carpenter—G. Bilsby.
Steward—J. Sullivan.
Sailmaker—G. W. Rolfe.
Boatswain's Mate—J. S. Good.
Steward's Assistant—J. A. Chester.
Able Seamen—A. Casement, R.N.R.
Owen Riley.
Cook—John H. Maxwell. *Second voyage only.*
Able Seamen—F. W. Burton.
G. R. W. Leary.
W. W. Hender.
L. Burgess, R.N.R. (*Russian medal for saving life*).
James Paton.
R. A. Beaumont
Herbert D. Jarvis.
W. E. Knowles.
Second Engineer—Walter J. Marsh. } *Second voyage only.*
Firemen—F. W. Kempe.
David Nelson.
John S. Partridge. } *Second voyage only.*

To the Government and people of New Zealand a great debt of gratitude is due. When we were in our greatest difficulty about despatching the relief ship in 1902, the Government of New Zealand generously came forward with a subscription of £1000. Nothing can equal the hospitality and kindness of the people of Christ Church and Lyttelton, their desire to help the expedition in every possible way, and the interest they have taken in its welfare.

I know that I speak in the names of all the officers and men of the *Discovery* and *Morning* and their relations, and of every one who has in any way been connected with the expedition, when I express our thanks to our indefatigable Antarctic Secretary, Mr. Cyril Longhurst. Arranging the archives in apple-pie order, keeping the intricate wages accounts, conducting official correspondence, looking after our business of all kinds, Mr. Longhurst has been indispensable, and has worked hard and zealously for five years. Always anxious to keep the relations informed, always prompt to oblige any one connected with the expedition, always willing and ready with help or advice, we all feel that the business and the work would have been very different without our secretary, equally the staunch friend of all, from the captain to the cook's mate. The expedition has been fortunate in many things, in none more than in the acquisition of Cyril Longhurst as its secretary.

We now look forward to the happy return of the *Discovery* in the autumn. Our arrangements respecting the collections are satisfactory, for the Trustees of the British Museum have undertaken to organize and publish the biological and geological results. The magnetic work will be undertaken by a Committee of the Royal Society, and our Council has undertaken the expenses connected with the meteorological observations. We shall all, indeed, all England will, unite in welcoming our Antarctic heroes, who have done so much to uphold the credit of their country. There will be the ceremony of presenting Captain Scott with the special gold medal, and Captain Colbeck with the Council's present. I hope also to have a second meeting of experts to discuss the various problems which the work of the explorers have helped to solve.

In conclusion, I would say that, if the opinion of one who has served in a polar expedition, and has studied polar work for half a century with close attention, may be stated, this is the best-conducted and the most successful expedition that has ever entered the polar regions, Arctic or Antarctic.

THE NATIONAL ANTARCTIC EXPEDITION.*

By Commander ROBERT F. SCOTT, R.N.

SUMMARY OF PROCEEDINGS.

THE following report of the work of the National Antarctic Expedition from March, 1903, dated "*Discovery*, Auckland island, March 23, 1904," has been forwarded by Commander Robert F. Scott, R.N., to the Presidents of the Royal and Royal Geographical Societies, and is published here with their sanction :—

"My report of proceedings forwarded by the *Morning* in 1903 was intended to amplify the telegram despatched at the same time. I understand the latter was altered out of all recognition by Reuter's Agency, and therefore fear the report must have been somewhat obscure in places. I trust it is understood that these reports purport merely to outline the movements and work of the various members of the expedition. I purposely refrain from such matters as the results of scientific observation and investigation, preferring to leave these to the reports of the various officers specially concerned in them.

"The winter closed in very rapidly after the departure of the *Morning* on March 2, 1903, temperatures fell, and the weather became gloomy, but there was little snow. Some ice broke away, but the open water never came nearer than within 4 or 5 miles of the ship. The month of March was occupied principally in laying in a store of seal-meat and flesh of skua gulls for winter consumption. Fish-traps were also set, but though at first these were very successful, they soon ceased to provide any substantial addition to our fare. The articles supplied to us by the *Morning* consisted principally of tinned vegetables, soups, sauces, herbs, pickles, and bottled fruits. They were not absolutely essential, but they greatly added to our comfort. Of such necessaries as biscuits, flour, oatmeal, and sugar we had an ample supply, and from this time we ceased altogether to use tinned meats.

"When April came without change in the ice-conditions, we were forced to abandon all hope that the ship would be free. The *Discovery* had been prepared for sea, but she was now again dismantled. The winter awning was spread, and snow was placed on the decks. We soon came to understand that our second winter was likely to be far pleasanter than the first. Experience suggested numerous ways in which the material comfort of the living-quarters could be improved. The men were in excellent spirits, much exercise was taken, and games of hockey continued until the light failed. But the greatest advances were made in respect to the food and light. It was only after his departure that I fully appreciated how far our wretched cook had gone in spoiling the food. Under new arrangements, the food was always appetizing, and though seal-meat was the principal fare, all hands partook of it, and continued to enjoy it thoroughly.

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* An adequate map, showing the exploring work of the expedition during the two years, will be published in the August *Journal*.

"The light provided throughout the second winter was acetylene gas. A stock of calcium carbide had been obtained for the hut, and this was now brought into use with a single burner in each compartment of the living space. The light was brilliant, and had a most happy effect on the comfort of the community. This beautiful illuminant is in every respect excellently adapted for use in a polar winter. Generally speaking, we had less wind in the early winter of 1903 than in the corresponding season of 1902, but in the latter months of 1903 the wind increased considerably, so that the averages for the two seasons differ but little. The temperatures during the latter season have been far lower. I have already remarked that the *Discovery* lay in a most sheltered spot. The difference in temperature between a thermometer in the screen and one placed 1½ mile to the south was rarely less than 10°. It was in this outer position, in the month of May, that we read the low temperature of $-67°·7$. From this time the temperature rose until it again fell in the spring. We had no heavy gale or snowfall until the second week in June, when a heavy southerly blizzard again buried the ship in drift. We had not sufficient photographic paper to get a complete record with the Eschenhagen instruments throughout the second season, but Mr. Bernacchi used such paper as remained to obtain records of the most interesting periods. In all other respects, the routine of observations was maintained as during the first season.

"Ample employment for the men was found in preparing for the spring sledging. This involved much repairing and renewing and some change in design of the equipment. In drawing out plans for the coming sledging season, I thought it wise to fix its conclusion at a comparatively early date, in order that all hands might be available to assist in releasing the ship should the opportunity occur. The date fixed was December 15, as at this time, in 1902, the open water was within 9 or 10 miles of the ship. In arranging the extended journey, I was confident that without dogs it would be useless to attempt to penetrate further to the south. My experience of the barrier surface and some arithmetic convinced me that a party of men could not hope to reach beyond the farthest point of the previous year, however amply supported. The actual performance of the southern parties completely justified this view. Our course of the previous year had taken us well clear of the land to the south-west; but there remained many points of interest in connection with the junction between the barrier and the land, and especially in connection with some apparent straits which intersected the coastal mountains, and which we had only viewed at a great distance. In the second place, we did not know what lay to the south-eastward. We imagined the barrier to extend almost indefinitely in that direction, but we had no proof. Finally, I thought it possible, with the help of experience, to penetrate considerably further to the westward over the ice-cap of Victoria Land. Our small complement only admitted of two properly supported journeys and one unsupported journey. I decided that the supported journeys should be to the south-west and west, the unsupported to the south-east. The latter was entrusted to Lieut. Royds, the south-west journey to Lieut. Barne, and I arranged to lead the western party myself.

"The winter passed away with extraordinary rapidity, and without a single case of sickness. With the spring, the whole ship became very busy with immediate preparations for the sledging. The first spring journey was started on September 7, the party consisting of Lieut. Royds, Dr. Wilson, Cross, Whitfield, Williamson, and Blissitt. The object of the party was to visit the emperor penguin rookery, near Cape Crozier, and it was timed to hit off the period of incubation. In this the expedition failed, for these extraordinary birds appear to breed in the coldest and darkest months of the year; but, by a fortunate circumstance, they succeeded in procuring a number of deserted eggs. Dr. Wilson was able to take a number of notes, and the party brought back two live chicks, to which Cross sacrificed his sleeping-jacket, though the temperature was continually below −50°, and at lowest −62°. The party reached the ship on September 17.

"Lieut. Barne left the ship on September 12, placed a depôt to the south, and returned on September 20. His party included Lieut. Mulock, Quartly, Smythe, Crean, and Joyce. ' They experienced the lowest temperature for a sledging party on record, the thermometer remaining almost continuously below −60°, and registering as low as −68°. Under these very severe conditions there was only one very severe frost-bite. This was one of Joyce's feet, which on two occasions had to be nursed back to life for more than an hour.

"The western party of last year spent considerable time in crossing a range of foothills 4000 feet in height. I thought it possible to avoid this, and started on September 9 to find a new route and establish a depôt. The party included Mr. Skelton, Mr. Dailey, Evans, Lashly, and Handsley. We found an easy road up a glacier, and placed the depôt at a height of 2000 feet, 60 miles from the ship. Returning from this point in three and a half days, we regained the ship on September 20. We were to some extent sheltered from the extreme cold encountered by the other parties, but the temperature was frequently below −50°, and at lowest −59°·5. I have mentioned these temperatures, because I believe they are almost, if not quite, without precedent in polar travel, and they therefore afford the best possible proof of the excellent state of health of the ship's company.

"The extended south-western journey was started on October 6; the main party consisted of those persons who had laid the depôt, and the supporting party was in charge of Mr. Dellbridge, and included Wild, Heald, Allen, Pilbeam, and Croucher. Mr. Barne had also the depôt laid by himself, and some food remaining at depôt (A) from the previous season. The party was most unfortunate in experiencing an almost continuous south-westerly wind, with drift and snow, against which they could only march with difficulty over a wretched surface. The supporting party turned on October 28, and the main party, after a continuous struggle, reached the mouth of the strait in lat. 80° S. on November 14. They advanced a short way inside the strait, but were continuously headed off by ice-disturbances. On November 22 they turned, and, keeping as close as possible to the coast-line, they made their way homeward, arriving at the ship on December 13. The whole party showed evidence of their hard work. Mr. Barne and Quartly were somewhat overstrained, and the latter was placed on the sick list for a short time. The party was unfortunate in failing to penetrate further into the straits, as I had hoped they would; but their observations on the ice-disturbances, the finding of a lateral moraine of huge granite boulders, and other evidences, prove that the strait contains an immense glacier, one of the most important feeders of the barrier, and it shows indirectly the great extent of the land ice-cap to the westward of this position. One of the most important facts discovered on this journey was the movement of depôt A. The fact admits of no doubt, as the depôt was established on the line of transit of two well-defined peaks. It was found to have moved a distance of 608 yards across the line. This is the only definite measurement of a barrier movement we have obtained. It may be difficult to understand how vast all these ice-problems are to a sledge party endeavouring to solve them. Once amongst the disturbed ice, it may take days to reach a point but a few miles distant. Meanwhile, the party is repeatedly plunged into hollows, where they can see nothing, and the greatest care has to be exercised to avoid dangerous crevasses. On October 12, Dr. Wilson made another journey to Cape Crozier for zoological purposes. He was accompanied by Cross and Whitfield. The party had wretched weather, and on one occasion were practically confined to their tent for a week. Determined to continue his work, Dr. Wilson eked out his small supply of provisions by killing seals and penguins, and cooking with a blubber fire. They reached the ship on November 5. From lack of equipment, Mr. Royds was not able to start to the south-eastward till November 10. His party consisted of Mr. Bernacchi, Cross, Clarke, Plumley, and Scott. They were unsupported, and the direction taken admitted of no depôt. In spite of more or less constant south-westerly winds, thick weather, snowfall, continual drift, and a heavy surface, the party made steady progress, and turned on November 28 at a distance of 155 geographical miles from the ship. The whole journey lay over a monotonous plain, in which no undulation could be detected. The marching hours averaged over nine a day, and food was cut to a minimum. Knowing as I do the barrier surface, and considering the want of support, the impossibility of making depôts, and the monotony of the work, I think this journey cannot but be described as a splendid effort. It was by no means barren of result. Mr. Bernacchi obtained a most interesting and uniform series of magnetic observations with the Barrow circle; careful observations were made of the barrier surface, including several temperatures taken in the snow surface by digging and in crevasses. The latter are especially interesting, because we have often looked for evidence to show that the barrier is afloat far south of its northern edge, and I think these temperatures go far to prove it. The series shows a steady fall to a certain depth, after which there is an equally steady rise to the lowest point reached (19 fathoms). Such an effect can only be produced by the presence of water. The party reached the ship on December 10, all being in good health, though exceedingly hungry.

"The western party left the ship on October 12. The main party consisted of myself, Mr. Skelton, Mr. Feather, Evans, Lashly and Handsley; the supporting party of Mr. Ferrar, Kennar, Weller, Mr. Dailey, Williamson, and Plumley. The ascent, which led over the icy surface of a glacier, was in places extremely rough, and we soon had considerable trouble in keeping the sledges in repair. By October 18 we had arrived at a point about 5000 feet above sea-level, and 80 miles from the ship; but here, discovering that the runners of three out of four sledges were practically disabled, we had no choice but to return to the ship. With a final march of 31 miles, the ship was reached on the night of October 21. I decided to make a fresh start to the west with the main party only, and arranged for Mr. Ferrar to proceed independently with two men, Kennar and Weller. He elected to accompany my party to the summit, and to make his geological examination when returning, at his leisure. Accordingly, I again left the ship on October 26, with repaired sledges and a party of nine. We had further difficulty with the sledges, and were delayed by thick weather and heavy winds, but on November 4 reached a height of 7200 feet. Here we were forced to remain in camp for six and a half days, during the whole of which time the wind blew furiously from the summit, the air was thick with driving snow, and the temperature was continuously low. Two attempts were made to start, but frost-bites came so rapidly that we were quickly driven back to our sleeping-bags. Towards the end the very close confinement began to tell on the party, and I had decided to get away at all hazards, when the wind fortunately lulled. We managed to get away, and over the summit, whilst Mr. Ferrar started to descend. We were now at a height of 8900 feet, at which altitude we continued as we advanced to the west. The travelling conditions were exceedingly severe; our gear was badly "iced up" after the long stay in camp; the cold was intense, especially at night. The surface, though hard, was sprinkled with rime, which greatly increases the friction; but the most obnoxious element was a constant westerly wind, which cut like a knife. In spite of every effort, our progress became slower, and there were evident signs of fatigue in some of the party, though all endeavoured to hide it. On November 21 Handsley's chest gave him some trouble, and we were reduced to relay work. On November 22 I was reluctantly forced to divide the party. I selected Evans and Lashly as fittest to proceed, and the remaining three, much to their disappointment, were directed to return. By easy marches the returning party reached the ship on December 16, Mr. Skelton taking a number of observations and photographs on the way. The advance party was now able to make much better progress, and no further signs of fatigue appeared, though we increased the marching hours. Observations made at the most westerly camp show it to have been in lat. 77° 59′ S., long. 146° 33′ E. We made this camp on the night of November 30, and started to return on the following day. The summit of Victoria Land is a vast plain, in this latitude of a height of nearly 9000 feet. I am inclined to think that it is lower towards the north and higher to the south, but that the difference in level is slight. The wind is almost continuously westward. There was evidence that during the winter it blows with great violence from the west-south-west; during the summer it gradually shifts to the south-west and south, or even more southerly, when what I believe to be the only snowfall of the year takes place. Everything points to an extremely small snowfall. There are slight undulations or saucer-shaped depressions, the exact shape and extent of which it is impossible to determine. They are detected by differences of shade on the snow-plain, or with a levelled theodolite. The greatest difference in level seemed to be about 50 or 60 feet, and as the inclination is spread over a distance of 2 or 3 miles, it is imperceptible underfoot. Journeying east or west, we each day appeared to cross two or three long, low, irregular waves, the eastern faces and hollows of which were clothed with sastrugi of enormous height, whereas the summits and western faces were quite smooth, and afforded a good travelling surface. After a somewhat adventurous return, we reached the glacier, and made a *détour* down a northward arm, which we found to end far from the sea, and to be succeeded by a chain of frozen lakes. We returned to the ship on Christmas Eve.

"Mr. Ferrar left me on November 11 to return down the glacier valley. The valley cuts deep into the mountain ranges, with sides that are always steep and often precipitous, where the bare rock is exposed. The rocks are generally not difficult to reach, and the moraines give an excellent indication of the nature of the rock to be looked for. Mr. Ferrar's discovery of plant-remains alone indicates the importance of this journey; but in addition to this, he was able to make a fairly complete geological survey of an extensive district, and to secure evidences of the extent of former glaciations, and of the retrogression of the present one, which I feel sure will be of the greatest interest. The details of his work will appear in his own reports, and I would add that he deserves great credit for the practical manner in which he managed his small sledge party. He had only one sledge, and that had suffered greatly from the hard rough ice of the glacier, so that he was obliged to exercise great judgment in selecting his camps, and to travel extensively from each camp, in order, as far as possible, to save his sledge from breaking down. He returned to the ship on December 11. Lieut. Armitage, Dr. Wilson, and Heald were absent from November 23 to December 12, making a survey and examination of a glacier which flows into the strait to the northward of Mount Discovery; and on November 16, Dr. Wilson, Mr. Hodgson, and Croucher commenced a small trip of eight days, spent in examining the junction between the barrier and Erebus island.

"Dr. Koettlitz spent the greater part of the summer in bacteriological work. Mr. Hodgson took advantage of the fine weather to augment his collections. Mr. Ford remained on board as cook and steward; and Dell, who, on account of a wound in his arm, was prevented from sledging, was employed in training the dog-team. The team, which consisted of six young dogs, born in 1902, soon became highly efficient; at first, in supplying the sawing camp, and later, in communicating with the relief ships, they proved of the greatest use. Before leaving the ship, I had seen a large tent made in preparation for the summer work. I directed that this tent, together with the necessary stores and a boat, should be taken to the northward before December 15, that the tent should be erected in a safe spot to leeward of some islets, about 9 miles from the ship, and that sawing should be commenced near this camp as soon as the officers and men returned from sledging. I have already mentioned that in December, 1902, the open water was close to the islets. My intention to be back by December 15, 1903, was frustrated, and Lieut. Armitage took charge of the operations, but under considerable difficulties, for the open water was not now within 17 miles of the ship or 8 of the camp. Under these circumstances, he decided to start sawing near the camp, thinking that the saw-cuts might remain open, though the floes could not be detached till the outer ice had broken away.

"The sawing was commenced on December 18, and shortly after officers and men were divided into three watches of nine, which, by relieving one another, kept one saw continuously at work. The ice was from 7 feet to 8 feet thick, and the greatest length of cut accomplished in a four hours' watch was 40 feet, whereas to clear a channel it is necessary to saw approximately four times its length.

It was soon discovered, moreover, that the saw-cuts, being filled with slush, were rapidly refreezing. The prospect was not inspiriting, yet the work was cheerfully continued.

"I reached the camp on New Year's Eve, and, seeing the futility of the work which had now been in full swing for more than ten days, arranged to break up the camp and return to the ship. With the exception of Dr. Koettlitz, Mr. Ford, and my own sledge party, all hands were employed on the saw. The work was hard, and its hopeless nature must have been obvious to every one, yet it was carried on vigorously, in the evident determination that no effort should be spared in the cause of freeing the ship.

"It was most gratifying to see the splendid state of the health of the party. Sledging and sawing had combined to bring all into the fittest condition—appetites were enormous, spirits never flagged, and it would have been difficult to find a more contented community.

"The men returned to the ship on January 2. On the following day Dr. Wilson and I proceeded to the ice-edge, and camped on the westernmost headland of Erebus island, which I have called Cape Royds. We found here a new rookery of Adelie penguins, and a number of erratic granite boulders, and decided to remain some days. At this time the ice showed no sign of breaking up; a loose patch lay off its edge, coming and going with wind and tide, but effectually damping the swell.

"On January 5, we were looking to seaward from our tent, when the *Morning* hove in sight, shortly followed by another ship, for which we were wholly unable to account. After signalling through to the *Discovery*, and arranging for the transmission of mails, we went aboard the *Morning*, and soon learnt all the news. I need not say how concerned I was to learn the extensive preparations that had been made for our relief; the letters made it quite clear how this had come about, but it was impossible not to feel the keenest regret that our position should not have been better known and such a large outlay avoided.

"The instructions to abandon the *Discovery* cast a gloom over the whole ship; the spirit in which they had been issued was understood, but on the spot, face to face with the situation, the ultimate release of the ship appeared a certainty to every one. There was not one who would not have been prepared to back his opinion by remaining by her, or who did not shrink from the thought of leaving her. Up to this time, we had all held optimistic views of our chances of release in the present season. Captain Colbeck's report of a clear sea to the north was also cheering, but towards the last week in January, when there was little change in the ice-conditions, all began to grow despondent; it seemed as though the ice were determined to exact its tribute.

"The *Terra Nova* attempted to butt the ice with a full head of steam, but the result was insignificant; some explosions were tried, but more with the idea of ascertaining the best method of using them than from hope of an effective result. The distance was altogether too great for such attempts.

"To be prepared for all contingencies, I thought it wise to commence the transport of our most valuable effects to the relief ships on January 15. It was arranged that one large tent should be placed and kept halfway between them and the *Discovery*. The loads were taken to this tent by our own people, and from thence carried on by the sledge teams to the relief ships. The surface became so extremely heavy that the parties were obliged to spend each alternate night in the tent, and it was, therefore, only on alternate days that loads were despatched from the ship. By the end of the month, all collections, registers, instruments, and valuable books had been transported.

"The first general break-up of the ice commenced towards the end of January. A heavy swell entered the strait, and was felt very distinctly on board the *Discovery*. The ice went out very rapidly, and in large floes, which streamed away to the north-west. The result of our ten days' labour on the saws went out in one large floe. By the end of the month both ships were inside the glacier, 8 miles to the north. On February 3, the open water was within 6 or 7 miles of the *Discovery*, but by this time the swell had almost vanished, and the ice was quiescent. If the explosives were to be used, I now thought the distance warranted their trial, and went myself to the relief ships for that purpose. The ice-edge now extended in a straight line, approximately east and west, for a distance of 6 or 7 miles, and this broad front was more or less equidistant from the *Discovery* at every point. The slight swell that remained formed long cracks from 100 yards to 200 yards apart, parallel to the ice-edge, and extending its whole length. In course of time a lateral crack would suddenly spread from the edge to the outer crack, then in a very short time all the ice beyond the outer crack would strip away along the whole edge. These lateral cracks formed the lines of weakness, and it was in making them artificially that I hoped for good results from the explosives. A few trials proved so effective, that on February 6 an explosive party was sent from the *Discovery*, and all available hands from the *Morning* and *Terra Nova* were employed in digging holes for the explosion. The holes were made from the eastern extremity of the ice on a line towards the *Discovery*, and at intervals varied according to circumstances. The thickness, and in places the sodden condition of the ice, made this work most laborious, and I cannot speak too highly of the manner in which the crews of both relief ships stuck to their work. On more than one occasion, when the results warranted, they volunteered to continue throughout the night. Although at times the effects of the explosions were most inspiriting and great advance was made, there were several days when little or no good results appeared to be achieved, and as the season advanced each day became of greater importance. On

February 10 our prospects did not look bright; but on February 11 another big break-up of the ice occurred, and on February 12 the relief ships were within 3 miles of the *Discovery*. Explosions were resumed, and on the morning of February 14, this distance had been reduced to 1½ mile. At 5 p.m. on the same day another break-up commenced, and the men working on the ice could barely be picked up fast enough. The news quickly spread on board the *Discovery*, and all hands were soon assembled on Hut Point. The floes appeared to break away about as fast as the relief ships could steam through them. As usual, the broken ice streamed away to the north-west. A large pool of broken water had been gradually forming throughout the season off Hut Point, and at 11 p.m. the last strip of fast ice between this pool and the sea broke away, and amid much enthusiasm, the relief ships steamed round the point and secured abreast of the *Discovery*. Although the ice continued to break away to the south, it held fast in the small bay in which the *Discovery* lay, and here it was from 12 feet to 17 feet thick. On February 15 we were busily engaged in filling the boilers. In the night I exploded a charge which cracked the floe in all directions.

"Early on February 16, a final explosion practically cleared our small bay of ice, and the *Discovery* swung slowly round to her anchors, one of which was immediately weighed. In the evening the *Terra Nova* came alongside to give us coal, but later it blew hard from the south-west, and she again put to sea. A strong wind from this quarter was a most rare occurrence, and I expected that, as usual, the wind would quickly shift to the east; but, though it lulled in the night, in the morning it increased to a full gale without change of direction and with a rising sea. The *Discovery* has heavy anchor gear, but I knew the holding-ground to be bad, and that we were too close to the ice-foot to allow of cable being veered. Steam was raised with all despatch, but before the engines were ready the ship began to drag, until her stern was bumping against the ice-foot, and the moment that the engines were reported ready, I had no option but to weigh anchor. It was an unfortunate moment for a first trial of the engines, but all would have been well had we been able to hold our own till clear of the small shoal off Hut Point, barely a quarter of a mile from the ship. At first we did so, but later the strong current running to the northward round this point caught our bows and swept us on to the shoal, and she took the ground at 11 a.m., with wind, sea, and current all tending to place her farther ashore. In the afternoon it blew very hard, the ship bumped very heavily, and the seas broke over her. Knowing the shoals to be small, and finding a deeper sounding at the bow-sprit end, I tried with steam and sail to force her over the bank, but this only seemed to make matters worse. There was nothing to be done till the weather moderated. It was a very trying time, but every one behaved admirably, and arrangements for lightening the ship were discussed. At 6 p.m.

the wind commenced to lull, and shortly after 7 the ship was reported to be forging astern; in a few minutes there was no doubt of the fact. The engines were put full steam astern, and the ship rolled, until at 7.30 she slid off into deep water; whilst ashore, a good deal of the false keel was ripped off. Beyond this, I do not think the ship sustained any damage whatever. There was no increase in the leaks.

"On February 18, at the northern glacier tongue, we were joined by the *Terra Nova* and *Morning*, and we spent the latter part of that day and the night in dodging from side to side of the glacier, and getting in the small quantity of coal which the relief ships could spare. We received fifty tons of coal from the *Terra Nova*, and twenty-five from the *Morning*. To supply us with the latter amount, Captain Colbeck reduced his own stock to a minimum; but the total quantity was most disappointing, as, together with what remained of our own supply, we had now only 115 tons, and I knew this would be insufficient to carry out our programme of proceeding round Cape North should we meet with pack-ice. I was able to communicate my plans and wishes to the captains of the relief ships at that time. I wished, also, to water ship, and to pick up a boat which we had left on the glacier, but another gale sprang from the south-west on the afternoon of February 19, and we were forced to put to sea. We steered for the northward, the relief ships in company, and ran close along the coast-line, which was almost free of pack, as far as Cape Washington. Off this cape, on February 21, the *Morning* parted company and proceeded to the northward. As she is much better under sail and much worse under steam than the other ships, it was not desirable that she should remain with them. On February 22 we entered Wood bay, which was heavily packed, and watered ship; in the evening the ship was swung, and we proceeded to sea. The coast from Cape Sibbald to Coulman island was also heavily packed; keeping outside the pack, we met a heavy easterly swell, and during the night had much trouble with our pumps, having to put the fires out in the main boilers until the stoke-holes were cleared of water. In the morning we proceeded under steam, and passed close to Coulman island about noon.

"On February 24 we passed through the Possession islands, and shortly afterwards a bad strain in the rudder-head was noticed for the first time. We sought shelter and anchored that night in Robertson bay. The spare rudder was shipped and the ship ready for sea by 9.30 a.m. on the following day (February 25). To the northward of Robertson bay we found a vast number of birds and many streams of pack. The weather was moderately clear, and we had a good view of the coast-line, but during the evening and night were forced to keep well to the north. On the morning of the 26th it was very thick, and the pack-ice was all about us; before noon it cleared, and we proceeded along an open lead towards the land. Shortly after noon we arrived at the end of this lead; we were nearly abreast of Smith's inlet, and the coast-line could be very distinctly seen as far as Cape North, but the pack-ice extended on all sides of us. From the crow's-nest, however, the pack did not appear close, and I could see several promising leads along the coast-line. With another hundred tons of coal, I should not have hesitated to enter the pack; but we had now only eighty tons left, and I felt, under the circumstances, that it was an unjustifiable risk, more especially as the barometer was falling, and there were all the signs of an approaching gale. We spent the afternoon in sounding and dredging, and at 5 p.m. ran to the eastward to escape from the pack. With a strong ice-blink on our port hand, we turned north on February 27, keeping approximately on the meridian of 172° E. On the 28th we got a strong south-east gale, with frequent snowstorms. The engines were stopped at 3.30 a.m., and we proceeded under sail; two hours later we lost sight of the *Terra Nova*. Hoping she would pick us up, I stood steadily on under sail on the same course throughout the day and the following night, and we saw nothing more of her until she arrived at this place. At 4 a.m. on February 29 we wore ship and stood to the westward in about lat. 67½° S., continuing on the same course throughout March 1. During the whole of this time, and since February 26, we had constantly a strong ice-blink, and every evidence of pack on the port hand.

"Early on March 2 land was reported on the port bow; we made out a long island, which we took to be Russell island, but the upper parts were entirely hidden by cloud. We passed within 2 miles of the northern end of this island, the weather rapidly clearing, and the clouds lifting, until in the afternoon we could see the whole island and other islands to the north. We were much puzzled in placing the islands. Only one thing was clear: that the island to the south, if Russell island, was one island and not three. The solution of the problem flashed on me when I again looked at the sketch of the islands given with Balleny's log in the 'Antarctic Manual.' Accepting the southern island as Balleny's Sturge island, which it exactly resembles when viewed from the north, we saw that the number and outlines of the other islands agreed with the sketch, except that Peak Freeman was hidden in cloud, and we did not see Row island, which is described as low. Since that, Mr. Mulock has plotted the angles taken during the day, and we can now say with certainty that the Russell islands are in error, and that the island so-called is Balleny's Sturge island. Considering the meagre nature of Balleny's log, that this was the only information that Ross possessed of Balleny's discoveries, and that the latter only saw land at a great distance, I think the mistake may be easily understood.

"Our movements on March 3, 4, and 5 are best gathered from the table of positions.

Date.	Latitude.	Longitude.
March 3	67° 34′ S. ...	159° 54′ E., D.R.
„ 4	67° 24′ S. ...	165° 38′ E., Obs.
„ 5	66° 23′ S. ...	154° 7′ E., Obs.

"Throughout the day and night of March 4 we stood to the north-west, taking a north-east course on the morning of March 5, so that our track lay much closer to the assigned position of Cape Hudson than the positions would indicate. After passing Balleny islands, we saw no signs of pack-ice, but bergs were fairly numerous. We had continuously a long swell from the north-west-west, but little wind. It was thick on March 3, but quite clear on March 4 and 5, when we could have seen land at a great distance. Soundings taken on the three days gave an almost uniform and remarkable depth of 250 fathoms. On March 4, a fairly good haul was made with the trawl. On this day I was much tempted to continue in a south-westerly direction, but had again to deplore the insufficiency of our coal-supply. We had now little more than fifty tons left, and this, I knew, would be barely enough to carry us to the rendezvous. The *Discovery* is a wretched sailer, and in her present trim, with the small spare rudder, is almost unmanageable under sail alone, however the yards may be trimmed. When close hauled she carries almost full weather helm, and makes from three to four points of leeway. To economize coal, we had to remain under sail alone on more than one occasion when amongst bergs, and the situation was rendered more unpleasant by the fact that there were only four hands in the deck watch. Under steam and sail she behaves exceptionally well for a ship of her class; she is very stiff and weatherly, and we have never yet found it necessary to heave to.

"On March 5 we re-crossed the Antarctic Circle, after an interval of two years and two months. From this time we had almost continuous north-westerly and westerly gales until we arrived at Auckland island. The three days were spent under sail alone, but we made so much leeway that we were obliged to get up steam again. We sighted these islands on March 14, having been close hauled throughout. Early on March 15 we anchored in Laurie Cove, with ten tons of coal remaining in the bunker. The *Terra Nova* arrived on March 19, and the *Morning* on March 23. Both ships had experienced very severe weather; they had been driven far to the eastward, and had been repeatedly hove-to. We have here refilled our boilers, and received thirty-three tons of coal from the *Terra Nova*. The *Morning* is taking in ballast, after which we shall leave for Lyttelton in company.

"I would only at present notice in general terms the conduct of the officers and men of this ship throughout the expedition. I have given my reason for touching lightly on the scientific work accomplished, believing that each officer will receive full credit for his departmental labours, especially under the arrangements which have been made with regard to the scientific publications. But in polar expeditions there must always be times when all must work for the common good regardless of department; at such times there has been no need to ask for volunteers in the *Discovery*. On the sledges or on the saws, in coaling or watering the ship, or at any task that needed to be done hurriedly, officers and men have worked alike, and grudged no labour till the work was finished. The conduct of the men has been beyond praise. By them the monotony of the second winter was met with unfailing cheerfulness. Most arduous sledge journeys and the most severe weather were encountered in the same spirit, and with an intelligence that freed the officers from all anxiety as to their welfare. But the qualities of the ship's company has never been more evident than since our release from the ice. The difficulties I have mentioned, and many others which might naturally be expected after such a long captivity in the ice, were overcome only by incessant labour. It was, in the sailor's expression, 'Watch, and stop on,' and though many were almost worn out with fatigue, there was neither complaint nor demur when a fresh task was imposed. I shall hope to make their services better known to you on the return of the expedition. Although, as was shown, our small company were so thoroughly able to take care of themselves, and naturally felt some embarrassment at the extent of the relief expedition, I would not have it appear that we undervalue the services of the relief ships. Everything that could possibly be done for us they were only too willing to do. Captain Colbeck's arrangements with regard to stores, etc., appear to have been excellent, and this year, as last, he has shown himself ever ready to sacrifice his own interests to ours. His conduct of the relief expedition deserves the thanks of his former as well as his present employers. His services were ably seconded by those of Captain M'Kay of the *Terra Nova*. Of the officers and crews of both ships, I can only add that I believe they were almost as anxious as ourselves to see the *Discovery* released, and almost as pleased when that event was happily accomplished."

THE SWEDISH ANTARCTIC EXPEDITION.*

By Dr. OTTO NORDENSKIÖLD.

It is with a full consciousness of the great honour accorded me, that I have accepted the invitation of the Royal Geographical Society to submit to you this evening the first account given outside Scandinavia of the Swedish Antarctic Expedition, of which I was head.

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* Read at the Royal Geographical Society, March 21, 1904. Map, p. 128. The map is only a provisional sketch-map, as it has not yet been possible to draw up a map embodying the exact measurements of the expedition.

It was as a representative of your great Society that Sir James Ross, upwards of sixty-five years ago, embarked upon an expedition to the south polar regions that, as regards its results, has not to this day been surpassed. When, further, at a recent date, the determination was arrived at to renew in earnest the exploration of the least-known regions of the globe by means of an international effort, in which my expedition formed a part, the first vessel to leave European waters on that quest was the one towards the equipment and despatch of which the Royal Geographical Society contributed so materially. The splendid achievements of that expedition in the first year of its work no one can better appreciate and admire than I and my companions, who have had an opportunity of acquiring first-hand knowledge of the difficulties and dangers that Antarctic conditions of climate and ice present.

It would, consequently, be a work of supererogation to say anything in this audience as regards the importance and objects of modern south polar exploration work. I will merely recall the fact that, whilst England and Germany were the first nations to come forward with proposals for carrying into effect the resolution adopted at the International Geographical Congress held in London in 1895, by organizing exploration expeditions destined respectively to the Antarctic regions lying south of the Pacific and Indian oceans, it appeared for a time as though nothing was to be done towards equipping any vessel for similar work in the Antarctic region situated south of the Atlantic ocean, the region nearest to Europe, and possessing, besides, features of great importance, as being the only part of the Antarctic area containing large tracts of land free from snow, and as bearing a striking and particularly interesting analogy to the continent of South America, from which it is not far removed. That was the state of affairs that led me in 1899 to draw up the first plan for the expedition whose fortunes and results I now propose roughly to detail.

The numerous and manifold difficulties to procure in Sweden from private donors the wherewithal for the equipment of so extensive an enterprise, entailed a postponement of our departure from Gothenburg until October 16, 1901. When once fairly started, however, we lost no time *en route*, and by New Year's Day, 1902, we were able to leave Port Stanley in the Falkland islands, and so bid good-bye to civilization. It would not be too much to say that we had then drawn up level with our sister expeditions, which had sailed from Europe in advance of us. A brief call at the Argentine Observatory on Staaten island unfortunately proved of no avail, inasmuch as their instruments had not yet been set up, consequently it was not possible for us to compare our magnetic instruments until our return home.

On January 10, after a good passage, with no ice in sight, we reached King George island of the South Shetland group. In spite of all descriptions of those islands, the most accessible of the south polar lands, I must confess that I was surprised upon seeing them. I had expected to find a strip of shore free from snow, and showing a collection of the scanty vegetation found there. But, on the contrary, I beheld one glittering sheet of ice, bluish-white in colour, with only a few ruggedly steep peaks standing out dark against the white mass, which ends against the sea with a precipitous wall of ice.

There is surely nowhere in the world such a startling transition from one nearly adjacent shore to another as exists between the evergreen virgin forests of Cape Horn and this ice-desert, a counterpart to which is scarcely to be found in the northern hemisphere, and which commences at a latitude equivalent to that of the central parts of Sweden. A very short study of the region was sufficient to convince us that all previous estimates regarding the character of the climate prevailing there must infallibly be in error, and that a greater severity than has hitherto been assumed must be prevalent. The experience gained by our expedition has fully justified this first impression.

On the morrow we landed for the first time in our new world. By that time we had discovered, in Harmony cove on Nelson island, a small sheltered bay; the land behind was fairly free from snow, and the shores were populated by a large number of seals, penguins, and other representatives of an animal-life quite new and unknown to us. It may easily be imagined with what eagerness we hastened to make acquaintance with all these novelties. The botanist of the expedition secured a fine harvest, though the vegetation was not so luxuriant here as in some more sheltered spots on the Orleans channel. The bedrock proved to be a porphyrite, the age of which it is difficult to determine.

The first task that now lay before us was to investigate the so-called Orleans channel, discovered by D'Urville. There were good reasons for assuming that we should find that the channel formed a direct communication with the east coast. That, however, was not the case; we discovered that it turned off to the south-west and ran into the Gerlache channel, with no perceptible boundary between the two, the one consequently forming, in reality, a continuation of the other. At the same time we discovered the stretch of land uniting Louis Philippe Land and Danco Land, and I was already able in my report at the time to state my conviction, which our work of the succeeding summer afresh confirmed, that the former piece of land constitutes a continuation of Biscoe's Graham Land; thereby the existence of the so-called Dirk Gherritsz archipelago may be considered to have been disproved once and for all.

It would have been of great interest to have been able to continue our labours there, but we were constrained to hasten on to the east coast, where our main researches were to take place. Before passing on to the description of them, I will tarry a moment to point out the characteristic differences in the rock formation in these zones. To the west there stretches a lofty range of mountains, with bold jagged peaks surrounded by glaciers, which run into one another along the shore forming a narrow ice-foot. Further east, and also on the islands, the land is lower in elevation, and, as a rule, much more consistently covered with ice, so that, save for a few isolated points that rise like noonataks, and some perpendicular rocks, only occurring along the actual edge of the shore, the solid fundament is not visible at all. Of the very different nature in the environs of Seymour island, I shall later have an opportunity to speak.

On January 15 we entered Erebus and Terror gulf through the channel separating Louis Philippe Land and Joinville island. To this channel, undoubtedly the best access to the region, I have later given the name of Antarctic sound. Our intention now was to go along the coast as far south as possible. On our way we established a depôt at Cape Seymour, leaving at the same time a record of the progress of our journey. Even at this stage we could perceive that the condition of things as regards the ice was anything but promising, and only two days later I was roused early in the morning to climb into the crow's-nest and observe the ice-conditions. It was at once clear that our chances of being able to advance further were non-existent. To the south and south-east there was to be seen an almost solid mass of pack-ice, while to the west was rising a lofty ice-barrier, obstructing all view of the interior. At that juncture we were a trifle south of the 66th degree of latitude.

AN ANTARCTIC ICEBERG.

We now turned back northwards, and in vain endeavoured on our way to reach the Seal islands, which were completely ice-locked. There now remained two courses open to us—either to stay for the rest of the summer in the northern archipelago for the pursuit of scientific research, or to carry out our original programme by trying to find a way southwards through the ice further east, as Weddell once succeeded in doing. Unfortunately the summer was already far advanced, and as it was essential to avoid having to spend the winter frozen up in the ice, and we required, moreover, a fair margin of time for preparing and arranging our winter quarters, there was no great prospect of our being able to progress any great distance southwards on that tack. I was, nevertheless, loth to relinquish the matter entirely, and during the remaining days of January we continued our course eastwards. By the end of the month—thanks to fog and contrary winds—we had not got further than the 45th degree of longitude, and the only important result of our efforts was the discovery we made that the sea there has a very considerable depth, viz. of nearly 2000 fathoms.

It now behoved us to retrace our steps to Seymour island, in order that we might secure a fitting place for our winter sojourn. This procedure was entirely in accordance with my original plan, but, besides that, the idea I had formed of the region from the little I had already seen, convinced me that a more interesting district in which to winter, whether from a geographical or geological point of view, could not be imagined. On our way we paid a brief visit to Sidney Herbert bay, which I, even then, found reason to suppose was a channel rather than a bay. On February 12, early in the morning, we entered Admiralty inlet, where we soon found a small and, as we thought, sheltered bay, situated just where the snowless tract of country ends, and the extensive level ice-area of Snow Hill commences. There we determined to establish ourselves for the winter.

The members of the expedition who were to be my companions here were Dr. Bodman, meteorologist and magnetician; Dr. Ekelöf, physician and bacteriologist; Lieut. Sobral, assistant meteorologist; and two sailors, Jonasen and Åkerlundh.

A wind that began blowing from the north-east commenced to drive the ice down upon us ominously, so that only two days after our arrival, on February 14, the *Antarctic* had to set sail rather suddenly, leaving us behind on shore—not insensible, to be sure, to the feelings that the parting with our comrades under such circumstances inevitably gave rise to, but so full of work for the immediate future, that we had little time to indulge in wonderings as to the respective fates before us, and when, if ever, we were destined to rejoin our forces. There was an abundance of tasks awaiting our united efforts: the erection of a house and observatories, the arranging of all our properties, and the mapping out of the various scientific pursuits we were intending to take up. All hands were, consequently, fully occupied, but the success of our endeavours was very materially impeded by the state of the weather. From the very first we were exposed to severe storms and great cold, and that in spite of the season being what for that part of the world is the height of summer. Thus, ere it could be completed, our magnetic observatory was blown down, and one night all our Greenland puppies, which we were relying upon for very essential assistance, were frozen to death.

The same storm that played such havoc with our preparations and property on shore, dealt very harshly, too, with the good ship *Antarctic*, at that time in Bransfield sound. She was very much knocked about and damaged, lost the best of her boats, and only just succeeded in keeping off the rocks lining the coast. Our experience of both years seems to prove that there is no counting upon any summer from and after so early a date as the middle of February.

By the middle of March we had made sufficient progress with our labours to enable me to set out on a boat-expedition down Admiralty inlet, partly for the purpose of reconnoitring our surroundings, and partly to establish a depôt, to be of service on coming sledge expeditions. On the second night we were out a violent hurricane overtook us, and what with the cold—the thermometer registered zero Fahrenheit—and the heavy sea that smashed up the ice-floe upon which we had sought refuge, we came very near destruction. As it was, we had to remain for twenty-four hours exposed to the elements, for to put up our tent was quite out of the question. On the following day, however, we managed to put out again into open water, and return to our starting-point before the severe frost had time to effectually bar our passage.

EDGE OF THE ICE-PACK, WITH SEALS, IN THE WEDDELL SEA.

By that expedition I was able to establish that Admiralty inlet is in reality a channel, branching indeed to the south into two arms, which enclose the island on which Cape Lockyer is situated. This may be a suitable point to insert a brief geographical description of the surroundings of our winter station, such as we gradually discovered them to be in the course of our stay. The station was situated on an island, Snow Hill island, consisting for the most part of one unbroken dome of ice, named by Ross, Snow Hill. I made a thorough study of this land-ice, taking systematic observations with reference to its movement, registering the temperatures of different depths, variations in its structure at different seasons, etc. On all sides the ice displays a fine stratification, traceable to the original snow deposit. The ice forms one continuous mass, save for three small "noonataks;" * on the sea side it terminates in a perpendicular wall, varying in height from 10 to 100 feet; at the point where we had fixed our station, however, there is a sudden and abrupt break, the northern portion of Snow Hill island and the whole of Seymour island being free from snow, thus forming what is probably the largest snowless area existing in the whole of the Antarctic continent. These islands are formed of richly fossiliferous sandstones, permeated with basaltic dykes.

The two islands situated in Admiralty sound, Cockburn island and Lockyer island, and also the land facing them, to which I later gave the name of James Ross island, are mainly formed of beds of basalt tufa, which rest upon the same fossiliferous sandstone as exists in Snow Hill island.

On our return from the sledging expedition mentioned above, the winter closed in upon us, and for upwards of half a year we were practically confined within the four walls of our domicile. The house, constructed in Stockholm, had double walls of boarding, separated by an air space, and lined both inside and out with tar-board. We found the accommodation afforded us by this building quite adequate to its purpose upon the whole. In the middle was one large room occupying the whole breadth of the building, flanked on either side by two smaller ones; three of the latter served us as bedrooms, with sleeping accommodation for two in each, while the fourth was the kitchen. Over the whole extended a large garret. The space was limited even for our small party, but we considered ourselves well off, and could devote ourselves to whatever employments we had on hand. Nor did we lack for occupation. There was mapping work to be done, astronomical, magnetic, geological, bacteriological, and physiological researches to be

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* This is quite contrary to the statement of Sir James Ross ('Voyage to the Southern Seas,' ii. 344) that there are "no projecting rocks through it." It would be very important to know if this is due to a diminution of the thickness of the ice since that time.

carried out, and observations on the tides to be taken; so that our time and attention were fully engrossed. First and foremost we were concerned with the meteorological observations, which as a general rule were registered every hour all through both day and night. And here it is fitting to pause a moment to consider the results that these observations led to, for they go to prove that the climate that prevails in that region must be regarded, by reason of its unexpected severity, as possessing an exceptional interest. It was for a long time assumed that the winter in the south polar regions was, comparatively speaking, a mild one, and even the experiences of Gerlache and Borchgrevink had not given rise to any supposition that at a latitude of only 64½° a winter temperature averaging for the months of June to August (1902), −21·7 C. (−7° Fahr.) would be registered. The average temperature for the whole year worked out at −12° C. (+10° Fahr.), approximately equivalent to those of the Lena valley and of the Hudson strait territory, the two coldest regions at the same latitude in the northern hemisphere. The temperature proved, moreover, to be lower than that noted by Gerlache and Drygalski for more southerly latitudes than ours, and only 3° higher than Borchgrevink found 7 parallels nearer the pole, and 9° warmer than Scott on board the *Discovery* registered at almost 14 parallels further south. These facts would seem to render it very probable that the southern pole of maximum cold has a considerable

THE WINTER STATION AT SNOW HILL.

bias towards the Atlantic side of Antarctica. This observation, in itself, may be fairly deemed to demonstrate the significance of an expedition having been organized to that region contemporaneously with the two others to different parts of the Antarctic seas.

To judge, however, of the characteristics of a climate, it is not sufficient to consider the conditions of temperature alone; the conditions of wind, especially its force, must likewise be taken into account. A temperature of from −30° to −40°, which in still weather is by no means unpleasant, becomes well-nigh unendurable if a gale is raging. In regard to the frequency of high winds, I have no hesitation in asserting that our first winter was quite unique. At all events, the statements made with reference to Gerlache's, Borchgrevink's, and Drygalski's expeditions, denote that the average force and prevalence of gales with them were far less than was the case with us.

No words can suffice to adequately describe the terrible violence of these south-west hurricanes, which are accompanied by the severest cold ever experienced where we were. Everything outside is calm and fine; the barometer, however, is to be seen falling rapidly, though, after a time, it suddenly stops. On looking around the horizon, one then becomes conscious of a slight mistiness in the south-west; then come a few violent gusts of wind, and, within the space of a few moments, without any further interval of transition, the hurricane is upon one in all its fury. The atmosphere has become so thick with the fine snow-dust which is being hurled along in immense clouds, that it is impossible now to see more than a few paces in front of one. The snow comes driving through every chink and cranny, and settles everywhere and anywhere. To be outside the house is an impossibility, for one cannot proceed against the wind, which takes away one's breath, and the sharp crystals of frozen snow sting one's face beyond endurance. Bits of board, wooden boxes, and other trifles, become the sport of the gale that whirls them about on the floor, while even heavy articles are shifted from their appointed places. On the velocity of the wind increasing yet more, to as much as 70 or 90 miles an hour, the destruction and disturbance it causes become yet more formidable. Stones pelt upon the walls of the house, and the whole building is shaken; when all had become calm again, we were often obliged to use up the brief intervals of fine weather in searching for articles that had been blown away. Barrels of bread, big boxes with all their contents, one might then find far away on the ice. On one occasion the roof of the observatory had been transported about 1000 feet through the air, to be then smashed against the rocks. After one of the very severest of the storms, we made the disagreeable discovery that our largest boat had been carried along the shore for 100 feet and demolished against the ice-crags, while the oars and other material lay strewn about on the space between.

Descriptions of violent storms are familiar enough to the reader of reports of south polar research expeditions; the novelty, as far as we were concerned, consisted in the frequent occurrence and protracted duration of the storms that visited us. The average velocity of the wind for the eight winter months (March to October) in 1902 was 31 feet per second, which is probably a record for so cold a climate.

We were worst off in July and the first half of August, the temperature then falling as low as −42° Fahr.

From the middle of August things improved, and on the 18th we sighted and accounted for our first seal.

In the middle of September a strong warm wind from the north-west commenced to blow, and lasted a few days; it drove the ice away from the land, and we began to imagine that spring was already at hand. The gales and the cold returned, however, and at the end of September everything was as wintry as ever.

A VALLEY NEAR SNOW HILL STATION. MOUNT HADDINGTON VISIBLE IN THE DISTANCE.

In spite of its severity, the winter passed rapidly away, and we were happy enough in our surroundings; but it is easy to see that the conditions of the weather forbade my embarking on any extensive excursions from our winter quarters. In April, July, and August I made a few sledging expeditions, for the purpose of investigating Seymour island and Admiralty Sound inlet, but venturing further afield seemed too foolhardy and risky to be thought of.

With the approach of spring, however, I became anxious to be off, at as early a date as possible, to explore the unknown coast running southwards, and on September 30 we were at last able to start.

My companions were Lieut. Sobral and Jonasen. According to the plan I had worked out, I had hoped to be able to extend my absence from headquarters to a period of fifty or sixty days. Unfortunately, we had been unlucky with the dogs we had brought with us, and now the number available for our trip was four Greenland dogs, and one of these we had brought from the Falkland islands. It seemed an utter impossibility to do in any way with less than two sledges, and so I arranged that the dogs should all be harnessed to the heavier-laden of the two sledges, and that Lieut. Sobral and myself should lead the way, dragging the other sledge ourselves. Furthermore, it was clear that it would be out of the question for us to have with us sufficient equipment for so long a period as fifty days, if our rate of advance was not to be retarded altogether too much, so that I determined only to take dog-pemmican for three weeks, confidently hoping that we should encounter on our route along the coast both seals and penguins, which might serve as food for the dogs.

For the first week we were favoured with excellent weather and capital ice. Our rate of progress was, nevertheless, not equal to my expectations; I had good reason to observe how very much more advantageous it is to employ dogs as beasts of draught, in place of discharging that labour one's self, more especially when it is desirable to advance quickly.

The course we followed during that first week led us parallel to, but at some distance from, the coast of an elevated mountainous country. The configuration of it was a series of rugged jagged crests, behind which there extended a large ice plateau, from which immense glaciers descend, leaving only the highest peaks snowless.

This coast territory forms a continuation of the land discovered by Larsen, and named by him King Oscar II. Land, and I consider that that designation should be applied to the whole coast territory as far as to 64° S. lat., where the Louis Philippe peninsula may be considered to begin.

On October 7 we reached Christensen island, which we found to consist of the remains of an ancient crater. I climbed to the top of it, and obtained a capital survey of the surroundings. A phenomenon was from this point of vantage presented to the view, which, so far as my own experience goes, has no exact counterpart anywhere else, though it is probable that it somewhat corresponds to the ice-terrace which is terminated by Sir James Ross's celebrated ice-barrier. The islands known by the name of the Seal islands are in reality a species of noonataks projecting above a low level ice-terrace, which at this latitude has a breadth of from 40 to 50 miles, and which extends as far south as we have knowledge of, at any rate, for more than one degree of latitude.

ary with the sea is an ice-barrier of varying altitude. It
able to me that this ice in part rests upon land, but also in
principally, covers a shallow sea, and that it has been for the
formed *in situ*. From a scientific point of view the phe-
above briefly described is of exceeding interest, though for
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pushed on, however, at an increasing pace as our burdens
hed in natural course, though the difficulties we had to contend

THE ICE-BARRIER NEAR SNOW HILL STATION.

with now began to thicken. A fresh period of storms set in, the temperature sinking to −20° to −25° Fahr. We had the wind in our teeth, and were fain, even for several days at a time, to lie still in our sleeping-bags on account of the storm. At length, on October 18, we neared the land. The last piece of our way across was the worst by far. Here the ice rose considerably higher, and was traversed by broad deep cracks, which we only succeeded in crossing with great danger and difficulty. We found ourselves, however, finally at the end of our troublesome journey, and were able to pitch our camp in the shelter of a lofty headland that apparently formed the south-easternmost point of King Oscar II. Land.

The very same night a hurricane arose that caused us great discomfort. Our tent was torn by the wind, so that we had the utmost difficulty in repairing it in the dreadful weather and in getting it set up again in a sheltered spot high up among the rocks. To crown our misfortunes, Jonasen fell down and injured his arm while engaged in carrying a big stone to help steady the tent. The provisions we had brought for the dogs were now at an end, and we were obliged to share our own pemmican with them. In this state of affairs, with a dearth of provisions and the broken and stormy weather, it could not be considered other than perilous to pursue our expedition, and I resolved that it was incumbent upon us to make our way back again.

The severe weather still kept on, but as we now had the wind behind us, we were not so often under the necessity of remaining stationary on account of it. We covered a great deal of ground every day, and had already reached our winter station once more on November 4.

Our journey out and home again amounted to about 400 miles in distance. The chief results we obtained were the discovery and the mapping of the inner coast-line as far south as 66° S. lat., and also the discovery and investigation of the great ice-terrace. We had, however, also carried out geological and meteorological work of considerable interest.

November was principally devoted to the pursuit of scientific research work in the vicinity of the station. At the beginning of December I undertook a sledging expedition to the northern portion of Seymour island, to study its geology. The strata there are characterized by the absence of ammonites, which occur in such large numbers in all the older strata which belong to the Middle or Upper Cretaceous; I assume that they are of the earlier Tertiary age.

In these strata I made two discoveries on the same day, and they are among the most important of the whole expedition. The first was a number of miscellaneous bones of vertebrates lying scattered about, principally the remains of a penguin, larger than any species now living. The second was a large number of tolerably well-preserved leaf-impressions belonging to a variety of forms. This discovery proves for the first time that in the south polar regions, as has long been known to be the case with regard to those round the north pole, a warm climate with luxuriant vegetation existed at a—in geological sense—recent period. I had, moreover, been able to collect remnants from the animal world that once inhabited that ancient continent.

Now the time arrived when we began seriously to look for the return of the good ship *Antarctic* to carry us away from our voluntary isolation. What a weary time of waiting and expecting that was destined to be! The weather was cold, with fog and gentle winds. Now there came no gales to assist in breaking up and dispersing the ice. Our summer time, spent at that spot 2° north of the polar line, was the coldest ever known up to that time. The British expedition, which was 14 parallels further south at the time, experienced a still greater degree of cold.

There were some small leads in the ice and a water-sky in the north, but no open channel that would admit of a vessel finding its way to us. Consequently we never became really anxious at the non-appearance of the *Antarctic*, and never thought but that she would eventually reach us. And well it was that none of us were able to surmise what a fateful drama was being enacted during those weeks of waiting almost within sight of our station

At the beginning of February there was a sufficient amount of open water along the shore for us to get by boat to Seymour island to kill some penguins for our needs in view of the coming winter. The task of slaughtering these strange creatures is by no means a pleasant one, by reason of the resemblance they bear in behaviour to human beings, and from the circumstance that by degrees one comes to regard them almost as companions in the solitude of those regions. We had, however, no choice in the matter. We accounted for some 400, but they had almost entirely disappeared by the time the relief came.

SANDSTONE CLIFFS (CRETACEOUS) NEAR SNOW HILL STATION.

We also killed at the same time all the seals we could get within reach of, partly to use their blubber as fuel, and partly for the sake of providing our dogs with food. Experience showed us, moreover, that we could consume seal-flesh with considerably greater relish than the hard and dry flesh of penguins.

By the middle of February heavy gales and intense cold had already set in, and very shortly we had winter all around us once more. I will not here speak about the winter; I will only mention that we were very fully occupied, and that we realized that the value of our observations would be very materially enhanced, now that we had a chance of registering them all over again. We naturally often wondered how our sister expeditions were faring, and almost hoped that they too had been constrained to tarry by reason of the ice, for the sake of thereby obtaining a new series of observations from their localities likewise. A comparison of our results and those of the British expedition should be exceedingly interesting, and not less so one between ours and those registered by Mr. Bruce at a spot so close to where we were.

We found the first months the most trying, when the long period of darkness was before us to be looked forward to; our isolation and the uncertainty as to what awaited us were what occasioned us the greatest anxiety.

As the spring once more came round, I started off again on a sledging trip, this time to explore the unknown parts north of our station. Profiting by experience, I determined on this occasion to take only so much as the dogs could manage to draw. To that end, I contented myself with only one companion. After one unsuccessful start, when our tent was torn by the wind, we got off on October 4. After passing Admiralty sound, we turned northwards into an inlet we had discovered the year before. The landscape we then had in front of us was of a grand description: to the west, the northernmost part of King Oscar Land, displaying the same bold and sharp outlines of mountains as we had observed further south; then further on, the hitherto unknown southern edge of Louis Philippe Land; to the east rises the majestic form of Mount Haddington, with its even-surfaced ice-slopes of opaque blue. As we progressed, it became more and more apparent that my primary supposition had been a correct one, and that we were now in a channel affording a through waterway, the land situated on our right hand consisting of islands. This remarkable channel, to which I gave the name Crown Prince Gustaf channel, derives its chief interest from the analogy it bears to the deep depressions on the eastern side of the South American Cordilleras, where, moreover, the formation of the mountains on either hand resembles that which I found to prevail here.

The passage through the channel occupied us about a week to accomplish. On October 12 we had at length reached its eastern extremity. We were proceeding rapidly on our way, when, under a high and precipitous rock on the shore, we suddenly caught sight of a couple of black objects of strange appearance. They were not seals; but what were they? My first idea was penguins, of which we had not seen any that year; but they were too large, and they moved about, too, in such a strange manner. I applied my glass to my eye, and at once made out that they were human beings.

Never before have I experienced such emotions as this discovery brought surging upon me. To come upon human beings in this desert wilderness, and for us, who for a period of twenty months had been fain to content ourselves with our own society! And who in the world could they be? Wild suppositions came before my mind in rapid succession, only to be rejected as soon as entertained, each seeming in turn more impossible and unlikely than its predecessor.

The figures had likewise noticed us, and now both parties set off towards each other. The nearer we approached them, the greater became my astonishment. The sight which presented itself to my astounded gaze was that of two men who were black from head to foot, having, moreover, long black hair hanging down over their shoulders, and black bushy beards. What rendered them, if anything, still more unrecognizable was the wooden eye-masks which they had probably invented themselves as a substitute for snow-goggles. The only thing about them that seemed to betray a certain degree of civilization was their skis. A feeble "Hurrah!" from them as we drew closer showed that the meeting with us was a source of delight to them.

CAMP ON SEYMOUR ISLAND, COCKBURN IN THE DISTANCE.

It was not until we had greeted them, and they had told us their names, that I realized who they were—none other than two of my own fellow-voyagers in the *Antarctic*, viz. Dr. J. G. Andersson and Lieut. Duse. They, together with one other member of the party, had left the vessel during the preceding summer to attempt to effect a junction with us, and now, after a winter spent in solitude, were again on their way to our station.

It would be impossible for me to find words to describe my thoughts at that moment, as I listened to that bare explanation of who and what those strange-looking creatures were. Surprise, amazement, and curiosity soon yielded place to keen and heartfelt sympathy within me, as I realized as in a moment what these poor fellows had had to endure. There was, indeed, every reason for feelings of surprise and amazement to come upon me. During the long months of our isolation, it was natural enough that I should picture to myself the first meeting with representatives of the human family. But in all my imaginings such a contingency had never presented itself that I should, on that occasion, play the part of the rescuer of individuals who, to all appearances, belonged to one of the lower types of men that live in the natural state, and who, indeed, in many particulars had been constrained to adopt the modes of life of such beings.

We now hastened back to the point from which our two strange friends had come upon catching sight of us, and on shore, beside their tent, we found the third member of their contingent, Grunden, one of the *Antarctic's* sailors, busy preparing their dinner. It was not quite so simple a matter as might be supposed getting there, for our dogs took fright at the forbidding-looking black figures, and were ready for bolting in any and every direction but the one we desired. They were, however, at length reduced to tame obedience, and on arriving we pitched our tent alongside the other one. We determined, further, to remain at the spot for the night, that we might celebrate the strange meeting as best we could with the means at our disposal, and find time besides to exchange news of how each party had fared since our separation.

By degrees we elicited the account of their doings. As Dr. Andersson, in the February issue of the *Geographical Journal*, has already published some information with regard to his and his companions' experiences, it will not be needful for me to do more than give an outline of the same. During the first winter the *Antarctic* had been very successful as regards scientific work, and had collected many valuable results. At the beginning of November, 1902, the vessel left Tierra del Fuego, full of the most hopeful anticipations for what lay before them. But Fate had determined otherwise. While they were still considerably north of the South Shetland islands, they encountered pack-ice, which they had great difficulty in making their way through. Bransfield strait and Orleans channel, on the other hand, were almost clear of ice, and there they spent a couple of weeks, which were very agreeable and fruitful of results. At the beginning of December they pursued their voyage, now bound direct for their destination, our winter station, that they might bring us away, and so accomplish the object of their mission. The distance that separated them from our station was so short that, had the conditions of the ice been as in the year before, they would have reached us in twenty-four hours. As soon as they entered

Antarctic sound, they found the whole of the Erebus and Terror gulfs filled with ice, with hardly a fissure in it. An attempt to go round Joinville island proved unsuccessful, and on their return, at Christmas-time, to Antarctic sound, the ice was as solid as ever.

It was at this time that Dr. Andersson formed the brave resolve to try and make his way to our station. They landed in a small bay on the western shore of the Antarctic strait on December 29; the bay was subsequently christened the Bay of Good Hope. They at once started off on their march, but soon found that the state of the ice at that time of the year was such as to preclude so long a journey, and they were forced to return to their starting-point, there to await the return of the *Antarctic*. Their wait proved, however, long and fruitless; they were never to see the vessel again. At first they worked away eagerly at investigating the neighbourhood from a scientific point of view, and it was at this time that Andersson came upon a well-preserved fossil flora from the Jurassic Period, which proves that the vegetation here at that time was the same as that of India.*

As the summer gradually passed away, and they saw no sign, they began to be uneasy, and commenced to prepare for the coming winter by collecting provisions, and by erecting a hut of stone. The hut was constructed in the following manner: round and about their largest tent they built a thick stone wall, and over the whole they placed a piece of tarpaulin. The abode was thus provided with double walls, and when the snow came and heaped itself all round, they were able to keep up an average temperature inside of but little below freezing-point. They used seal-blubber as fuel, making the fire in a large preserved-meat tin, without employing any wick; by practice they acquired considerable skill in the art of firing by those means. They partook of a small portion of bread every day, and a cup of a brown liquid, supposed to represent coffee; they indulged themselves, besides, in preserved meat or fish once or twice every week, but otherwise their sustenance was derived from the flesh of seals or penguins, boiled in sea-water instead of salt.

The part of their lot they found hardest to bear was the protracted confinement through the long stormy winter; they had often to remain lying in their sleeping-bags for several days in succession without any light, and, moreover, without anything to read, had they been able to see. The winter passed wearily away, and with the advent of spring they began to get in trim once more for a sledging trip to our station. The stores they had carefully treasured up were produced, but they had only one sail-needle between them, and they had to take it in turns to have the use of it for the repairing of their various garments. They set forth on September 29, and here we had met in this marvellous fashion out upon the ice.

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* According to Prof. Nathorst, these fossils agree pretty well with those from the Upper Gondwana series in India; also with those described by Kurtz from the province of Neuquen, in the Argentine Republic.

With rapid marches we now hurried back to Snow Hill, choosing a passage further inland, that forms a connecting link between Crown Prince Gustaf channel and Sidney Herbert bay. Our return was, naturally enough, the signal for great rejoicing among those we had left behind. On finding ourselves at home again, we at once recommenced with fresh eagerness our scientific avocations, and not a day passed without some of our party being absent on exploration bent. Dr. Andersson and myself spent most of our time on Seymour island, collecting specimens from its rich strata of fossils. We had never enjoyed such beautiful weather as now since we first arrived in those regions. The sea further out was almost clear of ice, and it was not without a degree of anxiety that we contemplated the possibility of our labours being cut short prematurely by the expected arrival of the rescue expedition. But up to that time we had not relinquished the hope that it would be the *Antarctic* herself that would come to carry us off, and in that case we should be able to look forward to a summer of busy occupation, yielding valuable results.

On November 8, when two of our party were absent egg-collecting, and the rest of us were at home at the station, some one entered my apartment and informed me that there were some people to be seen out on the ice; "but," he added, "it looks as though there were *four* of them." The excitement that ensued, when the telescope confirmed this supposition, is easier imagined than described. We all hurried out, helter-skelter, and down on to the ice, to welcome the new-comers, who we judged could not well be any others than members of the *Antarctic's* contingent, since it was as yet too early, as we calculated, for any vessel to have reached us from Europe.

What by rights should have been the most joyous moment in the whole history of our journey was turned, at a blow, into the most sorrowful and melancholy, on our learning, from the two foreign officers before us, that no news had come to hand of the *Antarctic* or her crew. This intelligence was such a shock to me, that I stood rooted to the spot, as one paralyzed. I could not but own to myself that the chances of ever seeing our comrades again were exceedingly remote.

The officers we were confronted by, who had such gloomy tidings to bring us, were Captain Irizar and one of the officers on board the Argentine frigate, the *Uruguay*. They had made the expedition for our sakes, and now invited us to accompany them home. Through them we learnt of the Swedish expedition, under command of Captain Gyldén, also despatched to our relief. The *Uruguay*, however, had brought no letters or official communications for us.

The circumstances being as above related, there was practically nothing for us to do but gratefully to accept the proffered means of returning to civilized parts of the Earth. The day passed quickly, and towards evening the Argentine contingent returned to their vessel. That they might lose no unnecessary time on the way, I instructed Jonasen to put the dogs into the sledge and drive them across. Later in the evening we were each and all of us silently and thoughtfully busy at work in our house, I myself being occupied with the report I was intending to leave behind us at Snow Hill for the guidance of the Swedish Relief Expedition, containing suggestions as to the best means of endeavouring to discover the fates of our comrades on the *Antarctic*, when suddenly the dogs outside began to howl fiercely.

EMPEROR PENGUIN.

The noise led to one of the party going to the door to look out, and on returning he announced that there were some people down on the ice. I at once framed and announced the supposition that it was merely Jonasen coming back, and that Captain Irizar had sent some of his crew with him to render us assistance in packing up our goods and belongings. We were all so engrossed in what we were doing, that we never even troubled to see if it was so or not. Then, however, such a long pause ensued, without anything further being heard, that eventually Bodman got up to make certain as to what was going on. All of a sudden, we were startled to hear from without wild yells and cries and hurrahs, among which the only distinct words we were able to catch were "Larsen, Larsen." We all instantly now left our several tasks with one ado and made for the open—and, lo and behold! whom should we see standing on a knoll in the wondrous half-light of an Antarctic summer night, but Captain Larsen himself and five of his men, weathered of feature and disreputable of garb, but sound and well of body and limb.

After an absence of almost two years, here they were again—turned up in the middle of the night succeeding the very day upon which we had received intelligence causing us to despair of ever seeing them again; they had at length reached us at the very juncture when relief and rescue were offered us, in which they too would now be able to share.

In course of time we obtained from them the details of what they had experienced and gone through during the period that had elapsed since they put Andersson and his companions ashore to make their way to us. They had first tried to circumnavigate Joinville island, but had very soon got stuck fast in the ice. With persistent energy they had nevertheless held to their course, and had succeeded in making some advance, so that, by dint of availing themselves of every opportunity that presented itself, they had ultimately got approximately on to a level with our station, and by help of the telescope had been able to distinguish the low hills in our vicinity. It was then misfortune overtook them. For several days the vessel was wedged fast in the ice, drifting they knew not where, owing to the snow-mist that prevailed all the time.

On January 10 a violent gale from the south arose and compressed the ice in the Erebus and Terror gulfs. The ice-blocks were piled higher and higher all around the long-suffering vessel; the stern was forced upwards more than 4 feet. Then there came a huge block of ice, loftier than the others, and with a long projecting ice-foot under the surface of the water. This monster struck the ship from beneath and broke the keel, tore up the bottom planking, bent the propeller-shaft, and so severely compressed the after-part that its timbers gave way and let in floods of water. The condition of the vessel and of those who manned her was now become desperate. All the pumps were brought into requisition, and everything was made ready for leaving her at the shortest notice, if need arose.

The end, however, was not to be yet. For upwards of a month efforts were made persistently and continuously, both day and night, in the first place to get the vessel off the ice that had rammed her, and to stop the leak as successfully as might be, and subsequently to escape from the drifting ice, and, if all came to all, to run the vessel on to some shore, where her furniture, the food, and the collections might be brought into safety. All in vain, however. It proved impossible to use the engine, and with sails alone the ship was unmanageable in waters so crowded with ice. Finally, on February 12, it became clear that all hope was at an end. The vessel was moored to an ice-floe, everything that might come in useful was transferred from her on to the floe, the Swedish flag was hoisted, the moorings were let go, and all stood silently watching how the gallant ship, that had braved so many hard tussles with hustling ice and boisterous waves in polar seas both north and south, slowly and solemnly sank into her watery grave.

They now resolved to make for Paulet island, which, besides being the land nearest to their temporary refuge on the ice-floe, had also the reputation of being well supplied with both seals and penguins. The distance that separated them from the island was not more than 25 miles, yet it took them no less than 16 whole days and nights to reach it, though they laboured to the very utmost of their strength the whole time. Three large boats and an exceedingly heavy consignment of goods had to be dragged along across very uneven ice ; occasionally they had to cross drifting floes at the mercy of the currents. The worst part of it was, that the whole sheet of ice was in motion, so that it happened sometimes that they were drifted out during the night a greater distance than they had succeeded in advancing during the day.

At last, on February 28, they arrived at an open lead under the shore. The boats were hastily stocked with everything they could carry, while the remainder of the cargo was piled up on the ice. In that manner they succeeded in setting foot upon shore. They were intending on the following day to row out and fetch the pile of possessions they had left on the ice, but unfortunately during the night a gale sprang up, which dispersed the ice in all directions, and they had to rest content with having saved themselves and the few things they had had with them.

Now they were obliged to turn their attention to using the brief period of good weather that still remained to such profit as to provide themselves with a dwelling-place and with food before winter set in. A house was erected with double walls of stone, and with a roof consisting of a couple of sails and some sealskins. Penguins there were great quantities of, but, unluckily, the seals were not so plentiful, and their paucity was a serious matter, as they were so badly needed to yield blubber for fuel. It is an important thing to bear in mind that for purposes of heating the penguins are totally useless. By reason of their having such a scanty stock of fuel, they were reduced to only cooking once a day throughout the winter.

Time passed but slowly for them under such trying circumstances, with so many hardships to endure, and their spirits were naturally still further depressed when one of their number, the young sailor Wenersgaard, fell ill with some affection of the heart, to which he very shortly afterwards succumbed. In the sombre darkness of the depth of an Antarctic winter, he was laid to his rest beneath a stone cairn upon the shore.

But I will not stay to describe in detail the uneventfulness of that long and weary winter existence, but will rather pass on to the return of activity with the approach of spring. When the sun made its reappearance and began by degrees to climb higher and higher in the sky as day followed day, the penguins returned upon the scene, and the monotonous world around woke to fresh life. The first eggs that were available afforded an immense treat and were duly appreciated. By the close of October the ice had disappeared to such an extent that a boat could be launched. Larsen at once set off for our station, where he had turned up just at the right moment.

Amid, and in spite of, all the difficulties that their position entailed, they had nevertheless carried out a number of scientific tasks, as was the case, too, at Dr. Andersson's station. Of special interest are the meteorological readings which they registered, from the fact that they form so valuable a link between those taken contemporaneously at Snow Hill and in Scotia bay. In spite of the short distance, the average temperature on Paulet island seems to be several degrees higher than at Snow Hill.

There now remained nothing for us to do but to make all haste to get ready for embarking on board the *Uruguay*, so that she might proceed to Paulet island and bring off those of his crew whom Captain Larsen had left behind there. In the afternoon of November 10 we took leave of the spot where we had spent such a long time. Our feelings were not exclusively those of joy and happiness at being privileged once more to return to our friends and relatives at home; we could not altogether repress sensations of melancholy and regret at parting with the home we had called our own so long.

In the bustle of getting ready to depart, I had not found time for any sleep for a couple of nights, and the first on board was of brief duration, for I was anxious not to miss the impression that the approach to Paulet island affords. We rounded the last headland and came in sight of the island at about 4 o'clock on a brilliant summer's morning, with the sun just rising in the south-east. All of a sudden the unwonted sound of the vessel's steam-whistle rings upon the ears. Its effect is almost instantaneous, for we can observe how our long-lost comrades, twelve in number, who were doubtless lying dreaming of the longed-for relief which they thought yet so far away, come hurrying out of the heap of stones which had constituted their abode, to find out whence the strange and all-but-forgotten noise comes from, before they are willing to allow wild hopes to arise in their breasts.

A few hours later we were all collected on the deck of the *Uruguay*, and a week afterwards were walking about in the verdant forests of Tierra del Fuego, with butterflies flitting around us, flowers blossoming at our feet, and birds singing above our heads. On November 23, the telegraph from Santa Cruz was able to convey the news of our safety and rescue to those at home.

It now only remains for me to touch upon the scientific features of our expedition. The time at my disposal, however, does not allow me to attempt to give a comprehensive survey of our results, more especially as reference has been made in the foregoing narrative to the kinds of work we were engaged upon from time to time and in our several localities, and also as I have already found occasion to deal with several points in connection with our work in the February issue of the *Geographical Journal.*

Besides the extensive researches carried out in South Georgia, and also in the Falklands and Tierra del Fuego, as well as in the seas around and between those pieces of land, and in addition to the meteorological and magnetical work pursued with regularity at our stations during two years, the interest of which I need hardly dwell upon in this assembly, the chief significance of the work of our expedition, geographically, lies, I take it, in the circumstance that we had an opportunity of studying the whole of the district in its separate zones so completely, that it should now be possible, not only to establish a detailed comparison between it and the American continent, but also to obtain a definite starting-point for all future Antarctic research work in that hemisphere.

The whole of the mainland, and the majority of the islands lying nearest to it, have been mapped from the 66th parallel of south latitude and in connection with the area investigated by the Belgian Expedition. Furthermore, the seas that encompass those lands have been studied as regards their hydrography and their biology. Of our more detailed work the geological researches must be regarded as the most important.

The discovery of two fossil floras, one from the Jurassic period and one Tertiary, and the finding of richly fossiliferous marine deposits from both Cretaceous and Tertiary, lend a unique interest to this region, which will scarcely be surpassed by any other. If it is also remembered how favourable is the position which the region occupies, and what possibilities arise from the, comparatively speaking, extensive areas to be found here that are free from snow, it can scarcely be doubted that future expeditions will also here find plenty of scope for investigation and research.

Before the reading of the paper, the **President** said: We have the very great pleasure this evening of welcoming among us a very distinguished Swedish geographer who has lately, after suffering great hardships during over two years, returned home, bringing with him a very rich harvest of scientific results. A little over two years ago we wished him "God speed," and hoped to have seen him again in another year and a half, but, owing to the destruction of his ship and to other fatalities, he had to pass a second winter in that terrible climate, enabling him to perfect, to some extent, the scientific results which he has brought home, and which you will find, when he addresses you, are of exceptional importance. I now request Dr. Otto Nordenskiöld to address the meeting.

After the reading of the paper, the **President** said: His Excellency the Minister of Sweden and Norway will kindly address a few words to the meeting on the subject of this paper.

The **Swedish Minister** (Baron de **Bildt**): The kind reception extended in this country to my gallant and distinguished countryman Dr. Otto Nordenskiöld will, I am sure, awaken in our Swedish country a most sympathetic response. Our satisfaction at the way Dr. Nordenskiöld has been received here will be intensified by our knowledge that his work—I trust you will allow me to call it his magnificent work — that that work has been undertaken, to a certain extent, in co-operation with Englishmen. I need hardly tell you, but I would like to repeat it, that there is no name that appeals more mightily to us, your Scandinavian kinsmen across the sea, than the name of England, not only because England, to us a nation of seafarers, represents all that is most renowned in seamanship, but also because the name of England is synonymous with freedom, culture, and progress. We are proud of the work that Dr. Nordenskiöld has done in the Antarctic regions, but we are also glad and happy to think that he has riveted a new link in the traditional chain of sympathy that unites us to you Englishmen, and we trust and hope another link will soon be added, because we hope for the speedy and safe return of his fellow-expedition in the *Discovery*.

Lieut. **Shackleton**: I have not very much to say. I never reckoned, when I came home, I was going to do this sort of thing. All I can say is, I have a certain amount of interest in Dr. Nordenskiöld, apart from his gallant work in the *Antarctic*, because Captain Irizar, the naval officer who relieved him there, came to us to learn all about it. He knew nothing about Antarctic work before, but he soon got so familiar with the terms, such as "pack," that he afterwards said, on an occasion when he was late for an appointment, that he had been caught in the "pack" of Bond Street. Though an Antarctic explorer, I am not a very old one, so I leave any observation on the scientific part of the work to men who are far more capable of speaking about it than myself. I am very glad Dr. Nordenskiöld is here to-night, because he is a man who has a famous name, and is the nephew of another who is the only one who ever got from Europe through the Behring strait—Prof. Nordenskiöld.

The **President**: I am afraid Dr. Nordenskiöld's work has not yet been presented in a complete form, but still we are informed certainly that Jurassic flora has been discovered, and that it is identical with the Jurassic flora of India, and therefore I feel sure Dr. Blanford will be able to throw some light upon it.

Dr. **Blanford**: I can only congratulate Dr. Nordenskiöld on having made an eventful discovery. It is well known that one of the most interesting points, a point to which we all looked forward in Antarctic discovery, was to find land-plants on the Antarctic continent, for two reasons—because of the enormous importance of ascertaining whether in the far south, as in the far north, climates at an earlier period of the Earth's history were very much milder than they are at present, and this, I think, has been done; and also because any plants that were discovered would afford considerable aid in tracing the distribution of land in past times. It will be remembered that within the Arctic regions floras of different geological ages occur. Tertiary plants have been found in abundance; Jurassic have also been recorded; even as far north, I think, as Smith's Sound plants have been discovered precisely similar to some of those found in Europe and North America. We know that quite recently there has been a glacial epoch which has cooled the whole surface of the Earth—I do not think there can be any doubt that the whole of the Earth's surface was cooled—but it is also evident that at certain times in the past the temperature was so much higher than in the present day, that even in the Arctic and Antarctic regions vegetable life flourished. And it must be remembered that plants give a clearer intimation of past climates than animals in general do, because those portions of the animals which testify to the climate under which they existed have for the most part disappeared, whilst there is sufficient remaining of the plants to show under what climatic conditions they must have lived.

The other and extremely interesting point is that of the evidence afforded by plants of land-connections in various directions. I have no doubt that Dr. Nordenskiöld's eminent fellow-countrymen, to whom we are indebted for so many palæo-botanical discoveries, will clearly trace out the relations between these plant-fossils and those found in other parts of the world.

The PRESIDENT: It now remains for us to thank Dr. Nordenskiöld for the extremely interesting evening he has given us. It would be difficult to have listened to a more interesting narrative than that which he has told us, with hairbreadth escapes of the people on board the *Antarctic*, the terrible winter on Paulet island and Bransfield sound. We have all listened, I am sure, with great interest to his own work. He has told his story most modestly; but we can discern, from what he has told us, how zealously and how steadily he and his companions have worked throughout the whole of that long period. Hourly their observations have been taken; day by day they have searched in every direction to increase the value of their biological and geological collections, and the results are far-reaching and important, for I think there can now be little doubt that through their fossil discoveries they have at length established the fact, which was not much doubted before, but of which there was no proof—the fact that on that Antarctic continent, as in Arctic lands, there was once a warm tropical climate, and that also we may go further and say that he has probably established another fact—the connection of the Antarctic lands with South America. We must, therefore, congratulate our friend that his long and tedious work has been crowned with a most remarkable degree of success, and that he has come home bringing back most important scientific results. I am sure the meeting will join with me in voting to Dr. Nordenskiöld our most hearty and cordial thanks for what he has told us this evening.

Dr. NORDENSKIÖLD: I return my deeply felt thanks to Sir Clements Markham and to the Royal Geographical Society for the reception that they have given me this evening, for those kind words addressed to me, and for the great patience with which you have listened to my contribution. I am well aware that I have not been able to make it so interesting as I might, neither the narrative of our fortunes nor of our scientific results as a whole; but I hope I may be able to come back later, or perhaps in writing give you a fuller description of the work than what I have been able to do now.

A JOURNEY THROUGH NORTHERN UGANDA.*

By Major P. H. G. POWELL-COTTON.

I got my caravan together at Mombasa, and, starting on February 22, 1902, went up the Uganda railway to Stony Athi station. Our route† lay across the thorn-dotted Athi plain and along the western side of Mount Doinyo Sabuk, on whose grassy slopes the eye could follow the course of many streams, marked by the band of trees and scrub that edged their beds. Then, fording the Athi and Thika rivers, we left their shady banks to cross a succession of grassy plains till the Tithara was reached, beyond which the country grows more hilly and villages are numerous.

MOUNT SIRGOI, GWASHENGESHU PLATEAU.

At Mbirri, or Fort Hall, as it is officially called, we strengthened our caravan before proceeding north-west through a thickly populated district of the Kikuyu country. This region is well watered and very fertile. In every valley we passed extensive stretches of banana and sugar-cane cultivation, while along the slopes lay fields of Indian corn and other cereals, interspersed with occasional patches of tobacco. The villages were generally hidden in dense vegetation, no doubt with a view to concealment from the eye of possible raiders. From here we made our way to the western slopes of Mount Kenya, across a rolling grass plain, which at that time of year (April) was almost devoid of game. Camping at an elevation of 6900 feet, in the long grass on the edge of the forest which clothes the lower slopes of the mountain, we spent some time in a vain attempt to find bull elephants. We pushed our way through the dense belt of jungle which forms the outer edge, and entered a primeval forest, where perpetual twilight and an impressive stillness reigned. As we rose higher, the forest gave place to bamboo brakes, and at an elevation of 8900 feet I noticed the first tree lobelias (*Lobelia Deckeni?*), which are from 10 to 12 feet in height.

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* Read at the Royal Geographical Society, February 22, 1904. Map, p. 128.

† This is fully described by Captain B. Dickson, R.A., in the *Journal* for January, 1903.

INTERIOR OF CAVE, MOUNT ELGON.

When, however, we had climbed to an altitude of 9400 feet, and found ourselves still in the midst of thick bamboo, with no recent signs of elephant, we determined to turn back without having reached the rocky slopes which we had examined with the telescope from our camp.

We now set our faces westwards through a series of washouts, cut deeply into rotten sandstone and mud. Nearly the whole way across the plains of Laikipia the country was well wooded and appeared to be an ideal district for cattle-grazing, judging from the vast herds of antelope, apparently in the pink of condition, that roamed over it; while the belts of trees and little copses would provide a plentiful supply of timber and firewood. Crossing the Marmanet hills that form the watershed between the tributaries of the Gwaso Nyiro (which, flowing northwards and then eastwards, loses itself in the Lorian swamp) and the inland basin of Lake Baringo, we passed through a tract of forest land extending to the edge of the escarpment. This steep declivity, which forms the western edge of the great plateau lying at the foot of Mount Kenya, descends to the plain in three great steps or terraces, making in all a drop of some 2800 feet. A winding path led us over these terraces, down slopes covered with thorn-trees, to the Baringo basin below. I spent some two months in the neighbourhood of the lake, the water of which is quite fresh, even close in shore, except at the southern end, where, when a north wind is blowing, the mud brought in by the river Molo is stirred up.

Nearly in the centre of the southern half of Lake Baringo lies a little group of islands, on the eastern side of the largest of which a number of hot springs extend down to and under the surface of the lake. In all there are nearly fifty; the water in the largest is so beautifully clear that, although 20 feet in depth, you can see the bubbles rising from the bottom. Some of the smaller ones throw out only an intermittent jet, while others are continually on the boil. I found the water, which has but a very slight smell of sulphur, useful to cook my dinner in. Among the tumbled rocks of the hillside, behind the springs, there is a steam blow-hole, which hisses and booms continually. The neighbourhood of the springs is a favourite resort of the hippo, with which the lake abounds. Whether volcanic agency is responsible for the considerable fluctuations in the level of the bed of the lake in recent years, I am unable to say. The natives report that at times the steam blow-hole is very much more active, while the hot-water springs throw up jets incessantly. Judging by the water-mark along the eastern shore, the level must, at some comparatively recent date, have been much higher than at present, while the partially submerged trees on the island prove that either these have sunk, or that the water has at one time receded to an even lower level than its present one. Some of the older natives told me that they could remember the time when it was possible to walk from the southern shore of the lake to the islands, where now there is comparatively deep water. On the other hand, the north end is said to be much shallower than formerly. The lake swarms with crocodile, but they are so mild-mannered that, when my companion, Mr. Cobb, stepped on one, it merely wriggled out of the way.

At Baringo Mr. Cobb left me on his return to England, while I marched south-west to the Ravine station. From there I followed the route so fully described by Mr. A. C. Hollis in the January number of the *Journal*, through the Mau forest, across the Gwashengeshu plateau, to Mount Sirgoi, or, more correctly speaking, Mount Sirgoit. For a considerable distance round the mountain the plain is covered with fine pasture, which is kept cropped by the numerous herds of game in the district. To the north-east, situated in an abrupt dip in the plain, is a small salt lake, fed by a fresh-water stream. During my stay of nearly a month in this district, I had the opportunity of examining a number of the stone ruins mentioned by Mr. Hollis, but cannot agree with his description of their shape, as all those I found were circular, or nearly so, some 30 to 50 yards in diameter, and built of large unhewn stones, often at a very considerable distance from any apparent outcrop of rock. As a rule, they are situated on the top, or on the slopes, of rising ground; the interiors are dish-shaped, and contain smaller circular walls marking the sites of the old huts.

After entering the thorn country to the north-west in search of giraffe, I turned southwards, and made my way to the Government station at Mumia's, whence I visited the cave-dwellers on the eastern slopes of Mount Elgon. I was fortunate enough to find several groups of caves still inhabited, and was able to examine the homes and mode of life of the Wongabuney, as well as to get a number of photos of them. From Sir Harry Johnston's description, I had expected to find the inspection of these caves anything but an enjoyable experience, owing to their alleged filthy state. I was, therefore, agreeably surprised at the absence of fleas and at the general cleanliness, which was far greater than in most of the native villages. The interior of the caves is very irregular, as the harder part of the rock has been left jutting out in most inconvenient corners, while the softer stone has

ROCK CONE PEAK, MUROSOKA.

been cut away. That the whole inside surface of these caves has been hewn by the hand of man I have no manner of doubt, but the present owners are quite incapable of having executed such a stupendous task, and have apparently no knowledge of who the actual workers were. I think that a systematic examination of a number of these caves would result in some interesting light being thrown on their original inhabitants.

Following the mountain northwards, I crossed the Kiboko river. It is to this perennial stream that the Karamoja bring their herds and flocks for many days' journey from the north in the dry season. Between this river and Mount Debasien there are several cone-shaped hills, on one of which stands a curiously shaped monolith, which is doubtless a natural formation, but which, from a distance, has all the appearance of being the handiwork of man. Passing round the western side of Mount Debasien, I commanded a grand view of this most striking mountain, which from this side presents an amphitheatre of jagged red rocks and precipices, contrasting grandly with the dark-green foliage of the well-wooded valleys below. My search on the northern side for Lake Kagate was absolutely fruitless. No trace of its present or past existence could be found, nor had the natives ever heard of it. When I finally rejoined the usual caravan route, which passes to the east of the mountain, I turned northwards towards the Karamojo plateau.

At Murlinga, a place visited by Colonel Macdonald's expedition, I was obliged to spend some time procuring a fresh supply of donkeys and flour, and from here I made a day's march to the neighbourhood of the striking group of hills, Kizima, Kamalinga, and Nopak, which lie to the south-west. The two former have been rent asunder from top to bottom, the sheer sides leaving but a narrow rift between them, while the northern flank of Nopak and the western flank of Kizima present almost unbroken walls of rock. They are said to be uninhabited, and, in fact, no traces of either villages or cultivation were observable. On the way to Mount Moroto, in a north-easterly direction, I passed several large dams, which the Karamoja construct in this part of the country to collect and hold the small streams of water which flow only during the rains. These were now nearly dry, and I met whole villages setting out on their march southwards to the Kiboko river.

My camp was pitched in the Lea valley, at the foot of Mount Moroto, in order that I might visit the Tepeth, a curious tribe who only inhabit the top of this mountain and of Debasien. Their huts are two-storeyed, the only examples I have seen of such dwellings among African tribes. Although they are numerically very weak in comparison to the Karamoja of the plains, and, owing to the higher altitude at which they live, are able to raise corn and find grass for their flocks when the plains are parched with drought, they are held in such respect by the latter on account of their supposed magical powers that they are never molested. At first they were extremely suspicious of my intentions, and even more so of my camera; but when I took to butterfly-catching, they apparently concluded that I must be harmless, and so I was able to secure some pictures of them and of their dwellings.

At the southern extremity of the mountain I crossed a low spur, which formed a narrow divide between the streams flowing to Lake Kirkpatrick and those which go to feed the Turkwel. An abrupt descent of over 2000 feet from the Karamoja plateau led me into a large valley which drains into the Nakokoh, a tributary of the Turkwel. The northern flank of Moroto was formed by a great wall of rock, over which two fine waterfalls gushed. Striking across the western side of this valley, I searched the eastern slopes of Murosoka for the headwaters of the Tarash, which are marked on the map as rising on that side, but found that the whole of the drainage flowed towards the Turkwel. At that time of year the region was practically waterless, except for a few pools far apart, hidden in the clefts of the rocks. These were very difficult to discover without a local guide, whom we had not been able to obtain, as the country was quite deserted. After a good deal of fruitless search, during which I lost one man, while the rest of my party suffered severely from thirst, I at last found a road over the hilltop, and struck a tributary of the Tarash river, which cut through

NEAR THE TARASH RIVER, TURKANA.

a rocky gorge at the foot of the western side of the mountain. This soon led me into the Tarash valley, where the dry bed of the stream was from 50 to 150 yards in width. The valley was populated by Turkana, who owned large herds and flocks, and drew their water-supply from pits sunk in the sandy bed of the river. For three days I continued along the valley in a north-westerly direction, the elevation being between 2300 and 2500 feet. I then visited another valley, lying one day's journey due west, whence I again returned to the Tarash at a point further north, and, after following it for a day, struck off north-north-west to Mt. Zunut, while the river trended north-east. The natives reported that, within four days' journey, the Tarash reached a lake or swamp, called Loarding, which also received three other rivers, and that, during the rains, a big river carried the overflow waters to Basso (one of the many native names of Lake Rudolf).

At the foot of Mount Zunut lay a series of brackish pools, and in the neighbourhood the ground was dotted for miles with elephants' bones. Following the range, as it trended west-north-west, I crossed a low pass into a plain, called by the Toposa, Kotane, and to the north-west of it we found water at the foot of Mount Locorina. We again made across the plain in a south-westerly direction, left Mount Marangole slightly to the east, and traversed a low pass on its north-western flank: this led us into a broken country of small hills and ridges, extending in a westerly direction to the foot of the Dodinga hills. Here we drank running water for the first time since leaving the Kiboko river at the north of Mount Elgon, for hitherto we had had to content ourselves with pools in the clefts of rock, pits sunk in the sandy beds of rivers, or brackish puddles fouled by every beast for miles round. The south-eastern end of the Dodinga hills is bounded by Mount Lotuke, which is uninhabited. Mount Lokinya, about half-way along the range, forms the limit of the country occupied by the Dodinga race towards the north-west, the remainder of the chain of hills being inhabited by a tribe called the Oboya, who are in close relationship with the Dodinga. The hills consist of three parallel ridges running approximately north-west and south-east, and are intersected by numerous small precipitous valleys densely wooded. The villages are situated on the hilltops and on the shoulders of the upper slopes, the elevation being nearly 6000 feet, or 3000 above the plain below. On the low passes amongst the hills I noticed little cairns of quartz, of which rock there are numerous outcrops.

Descending the Dodinga hills to the south-west, I marched for three days across a plain covered with coarse grass and scattered thorn-trees to the river Kedef. Along the banks stretched a belt of country covered with sweet grass, palm trees, and thickets of tropical vegetation. It was a splendid grazing-ground, and was visited by every sort of animal found in that district. The sandy bed of the stream was from

LOBU VALLEY, MOUNT EGADANG.

70 to 200 yards in width, water being found in clay pockets along its edge. This was the first river I had come across that flowed direct to the Nile. One day's journey south-west brought me to Mount Cartebong, where I met an independent hill tribe called the Mielli, the first natives I had met with in the possession of firearms. They had extensive and well-cultivated fields at the foot of the mountain, and they derived their water-supply from rocky pools in the bed of a stream rising near the top. Their villages were perched on the upper slopes, and approached by steep, narrow paths, easily defended against an invader.

After a three days' journey in a north-westerly direction along the valley of the Kedef, or Kedepo, as the Mielli call it, I turned due west into the Lori valley, which stretches from the eastern slopes of Mount Egadang. It was a beautiful little fertile valley, watered by the stream from which it takes its name. Hills almost surrounded it, and the villages were dotted about the lower slopes of the twin peaks called Lourruer. Beyond the shoulder of the mountain lay another cultivated valley called Lobu. This was not so much shut in as the Lori, and the villages here were situated at the foot, not on the slopes, of the mountain. My route now lay past Mount Lohido to Obira, through much cultivated ground, with villages scattered here and there on the hillsides. From there I marched to Logguren, the present headquarters of Limoroo, the Latuka chief. His own village was situated at the foot of an isolated mass of rock, the sides of which were so steep that I could not walk up it without assistance, although it is dotted with groups of huts built on ingeniously devised platforms. The whole country round was thickly populated, great stretches of cultivation surrounding the villages, while the flocks found pasturage further afield. From here I made my way in a south-westerly direction along the lower slopes of that mass of mountains which is topped by Agoro. The way for the most part lay through well-timbered country, with tracts of swampy ground and tall reeds, following the courses of the numerous small streams. I spent some time hunting elephant at Obbo, on the upper waters of the Gomoro river, and then reached the Nile at the mouth of the Assua, across which an iron ferry-boat has been established. From there to Nimule the Nile flows through a series of narrow rocky channels, the tumbling water forming the most picturesque bit of scenery I saw in the 1400 odd miles of the river's course which I traversed.

From Nimule I marched to Wadelai along a wretched track, having to cross numerous unbridged streams, the depth of which varied from a foot or two to over a man's head. At Wadelai I passed to the western bank, and proceeded southwards to the Congo Free State station of Mahagi, which I found situated five hours from the shore of Lake Albert, at the foot of the main ridge. Here considerable progress was being made in the making of roads, the bridging of streams, and the construction of rest-houses for travellers. On my return to Wadelai,

A LATUKA VILLAGE AT LOGGUREN.

I was fortunate enough to get a passage in one of the two Uganda Government sailing-boats to Nimule, whence I marched to Gondokoro along an even worse path than that between Nimule and Wadelai. At Gondokoro I caught the monthly Sudan Government steamer to Khartum, and found the 1081 miles one of the most monotonous journeys I had ever undertaken, owing to the papyrus and long grass, which absolutely shut out all view. The hearty welcome accorded us, and the progress to be seen, first at the Congo Free State, and then at the Sudan Government stations, formed the only bright spots on the way.

BATHYMETRICAL SURVEY OF THE FRESH-WATER LOCHS OF SCOTLAND.*

Under the Direction of Sir JOHN MURRAY, K.C.B., F.R.S., D.Sc., etc., and LAURENCE PULLAR, F.R.S.E.

PART V.—LOCHS OF THE MORAR BASIN.

By Dr. T. N. JOHNSTON.

IN this paper it is proposed to deal with the results obtained by the Lake Survey in the fresh-water lochs lying in the basin of the river Morar, viz. Loch Morar, Loch Beoraid, and Loch an Nostarie. There were a number of other small lochs in this catchment basin, but as there were no boats on them, they could not be surveyed. Loch Morar is the principal loch in the basin, and it gives great interest to the whole area from the fact that it is not only the deepest lake in Scotland, but in the British Islands; indeed, the bottom of this loch forms the deepest hole in the continental plateau on which our islands are situated.

From the accompanying sketch-map (Fig. 1), it will be seen that Lochs Morar and Beoraid are parallel to each other, and run in an east-and-west direction. The overflow from Loch Beoraid, which lies about 3 miles to the south of Loch Morar, enters Loch Morar about its centre by the river Meoble, while the overflow from Loch an Nostarie, which lies to the north, enters Loch Morar at its western end by the river Loin.

The west end of Loch Morar is only about 500 or 600 yards from the sea, and its outflow is by the river Morar, which in its course falls over a rocky barrier, at the foot of which is a famous salmon pool.

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* During the present season six or seven members of the Lake Survey staff will be engaged in the detailed study of the chemical, physical, and biological conditions of Loch Ness, and Prof. Bachmann, of Lucerne, Prof. Wesenburg-Lund, of Denmark, and other foreign naturalists, are expected to take part in the investigations.

The larger Scottish lochs have all been surveyed, and several members of the Lake Survey staff are now engaged in sounding the smaller lochs throughout the country. Much difficulty is being experienced in getting boats to the smaller hill lochs, and Sir John Murray will feel much obliged to any highland or other proprietors or tenants who can assist him and his staff in the survey of these remote lochs. Plates, p. 128.

The total drainage area of the Morar basin is calculated at 42,000 acres, or over 65½ square miles. The whole region is rocky and mountainous. The district has not yet been mapped by the Geological Survey, but it is believed that the whole basin lies entirely in the crystalline schists of the Moine series of the Geological Survey, the main strike being north-north-east to south-south-west. The rocks seen at the barrier at the mouth of the loch are composed of hard quartzose flagstones or siliceous Moine schists. The direction of the hills at the belt which separates Loch Morar from the sea agrees generally with the strike of the rocks. Lochs Morar and Beoraid occupy true rock basins, but it seems almost certain that the outlet of Loch Morar was at one time to the south-west, because the col there does not rise more than 100 feet above the sea, and there is a

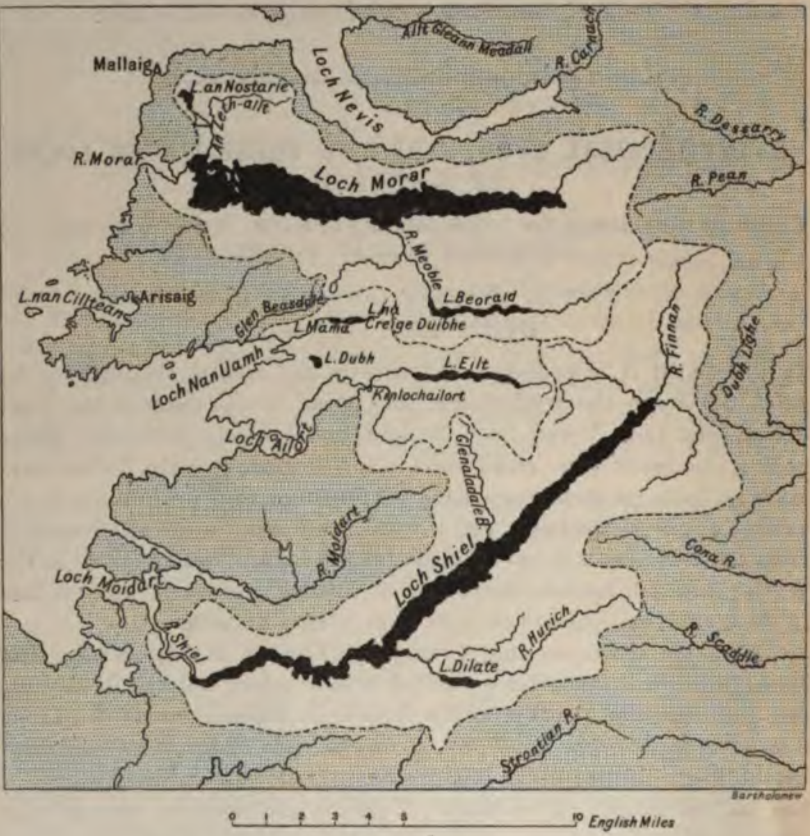

FIG. 1.—INDEX MAP OF THE MORAR AND SHIEL BASINS.

narrow belt of comparatively flat ground running southwards towards the source of the burn called Allt Cam Carach. It will be observed, by an examination of the depth map, that the deep water at the west end of the loch runs in the direction of this flat ground. Some deep borings along this flat ground might lead to interesting results.

Loch Morar (as well as Loch Beoraid) is a glen-lake which lies in a transverse valley—that is to say, in a valley the direction of which is independent of the geological structure of the region and crosses irregularly the strike of the rocks. This fact very probably accounts for the steep sides and the great depth to which the valley has been scooped out. Should the country be depressed about 40 feet, Loch Morar would be converted into a submerged valley and an arm of the sea like Loch Etive. By some observers it is held that the great depth of Loch Morar precludes the idea that it was scooped out by river-action or by ice.

Loch Morar (see Plate I.).—This is a large and beautiful loch, lying amid wild and magnificent scenery on the west coast of Inverness-shire, in the south-west portion of that county, immediately to the south of Loch Nevis, which is a sea-loch running inland for 12 miles from the Sound of Sleat. The west end of Loch Morar is about 3 miles from Arisaig, and 2½ miles from Mallaig. Morar station, on the Mallaig branch of the West Highland Railway, is within a few hundred yards of the west end.

The loch is a little over 11½ miles in length, and the maximum breadth is over 1½ miles near the west end; the mean breadth is nearly $\frac{9}{10}$ of a mile, or about 7½ per cent. of the length. The area covered by the lake is 6596 acres, or nearly 10⅓ square miles.

There are several islands, more or less richly covered with vegetation at the west end of the loch (see Fig. 2), and parts of the surrounding land, especially on the north side, are fairly well wooded, all of which greatly adds to the beauty and picturesqueness of the scenery at this part, but as one proceeds eastwards towards the head of the loch the scenery becomes wilder, the vegetation more scanty, and the mountains on both sides of the loch rise higher and more steeply. At many places on the north shore they rise precipitously from the water's edge, and around the head of the loch they reach a height of fully 3000 feet.

Loch Morar is fed by numerous small burns and streams, the largest feeder being the Meoble river, which, issuing from Loch Beoraid, falls in, after a course of about 3 miles, at "Camas Luinge," a bay on the south shore.

On the north shore, about 4½ miles from the head of the loch, is a large bay called "South Tarbet bay," and here a narrow neck of land about half a mile wide separates Loch Nevis from Loch Morar. A track which runs up the north shore of Loch Morar to Tarbet on Loch Nevis, crosses this neck of land by a narrow pass which rises to a height of 200 feet. For a distance of about 6 miles from the west end, the loch gradually narrows until a breadth of two-thirds of a mile is attained a little to the east of Brinacory island on the north shore, then it expands again to a breadth of over a mile opposite the entrance of the Meoble river; gradually it narrows again until at its eastern end the breadth is about one-third of a mile.

Depth of the Loch.—For a long time Loch Ness bore the reputation of being the deepest loch in Scotland, but in the year 1879 Mr. J. Y. Buchanan, F.R.S., showed that Loch Morar contained depths of over 1000 feet, which was deeper by several hundred feet than Loch Ness. In April, 1887, Sir John Murray took a series of eighteen soundings down the centre of the loch, the greatest depth recorded being 1050 feet. In September of the same year he again took twelve soundings at the deepest part of the loch, the greatest depth obtained being 1026 feet. All these soundings were taken by means of hempen-rope sounding-lines, as well as those taken in 1892 by Dr. Thomas Scott, who recorded a depth of 1020 feet. In June, 1896, Sir John Murray and the late Mr. Fred. P. Pullar made a bathymetrical survey of the whole loch with a wire-rope machine, but the chart they prepared was not published, as it was found that the machine employed was untrustworthy. It was therefore resolved to make a completely new survey. This was carried out in June and July, 1902, by Dr. Johnston, Messrs. Garrett, Hewitt,

FIG. 2.—LOCH MORAR, LOOKING EAST FROM THE WEST END.

(*Photo by T. N. Johnston.*)

Parsons, and James Murray. Since that date the loch has been frequently visited by members of the Lake Survey staff for the purpose of taking temperatures and making biological observations.

The surface of the loch at the time the survey was made, in June, 1902, was 30·5 feet above sea-level, and in March, 1903, the level was found to be 35 feet above the sea—a difference in level of 4½ feet. Altogether eleven hundred soundings were taken in the loch, or about one hundred soundings to the square mile; the maximum depth recorded was 1017 feet. This is less than previous results, but is to be accounted for by the use of wire rope, which nearly always gives a lesser depth than the soundings with ordinary sounding-lines. The general results are set forth on the accompanying map of the loch, with various cross-sections.

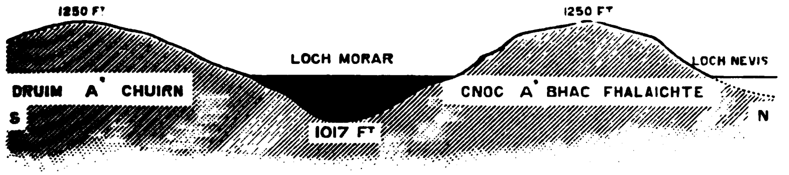

FIG. 3.—DIAGRAMMATIC SECTION ACROSS LOCH MORAR AND THE HILLS ON BOTH SIDES, SHOWING RELATION OF DEPTH TO HEIGHT. NATURAL SCALE.

Loch Morar is of simple conformation, the bottom falling on all sides down to the deepest part, but with here and there a few minor undulations of the lake-floor, especially in the wider western half of the loch, where the contour-lines of depth are much more sinuous in character than in the narrower eastern half. This is most noticeable in the vicinity of the islands at the west end; the line of soundings running south from Rudha Port na Coite shows several irregularities of the lake-floor, and causes the 300-feet and 500-feet contours to twist in a peculiar manner. Proceeding eastwards, the bottom undulates in such a way as to cut up the 700-feet basin into three portions separated from each other by shallower water, and towards the north shore, opposite Camas na Togalach, a sounding of 367 feet is recorded separated from the main basin by a shoaling of the bottom covered by 229 feet of water. Farther east, again, opposite Roinn a' Ghiubhais, the bottom shoals slightly, so as to isolate a small area exceeding 900 feet in depth from the main 900-feet basin. Opposite the entrance of the river Meoble, on the southern shore, a sounding of 97 feet was recorded comparatively near shore, which gives rise to a prolongation of the 100-feet contour-line in that direction. Towards the east end of the loch, opposite Sròn an Drutain on the north shore, a rise of the bottom was observed covered by 74 feet of water, surrounded by depths exceeding 100 feet.

The deepest part of the loch is at the wide portion opposite the mouth of the Meoble river; here, in the centre of the loch, the maximum depth of 1017 feet was obtained, at a spot nearly midway between the two ends of the loch. The area over 1000 feet in depth is not large, extending only to a little over 4 acres. One sounding of 1002 feet was obtained about 400 yards to the north-east of this area.

The area enclosed by the 900-feet contour extends to a length of a little over 2 miles, with a maximum breadth of a quarter of a mile, situated about 5½ miles from the west end of the loch and 4 miles from the east end. A small detached area over 900 feet in depth, with a length of half a mile, lies about two-thirds of a mile to the west of the main 900-feet basin.

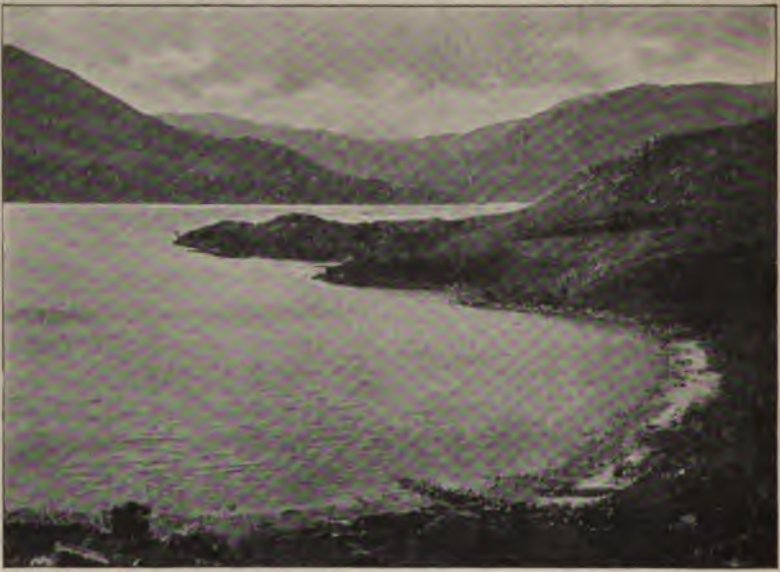

FIG. 4.—LOCH MORAR, LOOKING TOWARDS THE DEEPEST PART.

(Photo by J. A. Harvie-Brown, F.Z.S.)

The 800-feet contour encloses an area 4 miles in length with a maximum breadth of about one-third of a mile. It extends from 4 miles from the west end of the loch to within 3 miles of the east end.

There are three depressions over 700 feet in depth. The main one is nearly 5 miles in length, with a maximum breadth of two-fifths of a mile, extending from nearly 4 miles from the west end of the loch to within 2½ miles of the east end. The other two depressions are small; one lies about half a mile to the west of the main depression, and is three-quarters of a mile in length; close to its western extremity lies the third depression, which has a length of about one-third of a mile.

The 600-feet contour encloses an area which is 7¼ miles in length, extending from about 2 miles from the west end of the loch to 2 miles from the east end.

The 500-feet contour encloses an area extending to over 7½ miles in length, reaching from 1⅔ miles from the west end of the loch to about 2 miles from the east end.

The 400-feet contour encloses an area over 8½ miles in length, extending from 1½ miles from the west end to 1 mile from the east end of the loch.

The area over 300 feet in depth is 9½ miles in length, extending from nearly 1½ miles from the west end to a little over half a mile from the east end of the loch. There is a small detached area of over 300 feet in depth, about 5 acres in extent, near the north shore, a quarter of a mile to the west of Brinacory island.

The area enclosed by the 200-feet contour is nearly 10½ miles in length, extending from about a mile from the west end to about one-sixth of a mile from the east end of the loch.

The area enclosed by the 100-feet contour is over 11 miles in length, extending from one-fifth of a mile from the west end of the loch to a short distance from the east end.

The area covered by less than 100 feet of water is 2784 acres. The areas between the consecutive contour-lines and the percentages to the total area of the loch are as follows :—

Feet.	Acres.	Per cent.
0 to 100	2784	42·2
100 " 200	863	13·1
200 " 300	528	8·0
300 " 400	488	7·4
400 " 500	331	5·0
500 " 600	331	5·0
600 " 700	547	8·3
700 " 800	111	1·7
800 " 900	530	8·0
900 " 1000	79	1·2
over 1000	4	0·1
	6596	100·0

These contour-lines of depth approach each other very closely in many places, showing that the slopes are very steep at these points. A little to the west of the promontory called "Rudha nam Faiseachean" on the south shore, south-east of the islands, this is very marked, the slope being as much as 1 in 2½. Farther east on the south shore, off "Eilean Allmhara," the slope is again very steep, as it also is off Brinacory island, which lies almost opposite on the north shore.

As the surface of the loch is only 30 feet above sea-level, almost the entire bed of the loch is below the level of the sea. The area draining directly into Loch Morar is over 33,800 acres, or about 52 square miles.

The volume of water contained in the loch is estimated at

81,486,000,000 cubic feet, and the mean depth at 284 feet. Although Loch Morar is the deepest loch, Loch Ness has a volume three times as great, and its mean depth is 436 feet.

The deepest Scottish lochs next to Loch Morar are—

Loch Ness	751 feet.
„ Lomond	623 „
„ Lochy	531 „
„ Ericht	512 „
„ Tay	508 „

In the sea to the west of Morar there is no depth approaching 1000 feet, with the exception of a deep spot of 834 feet (139 fathoms) between the islands of Rum and Skye, so that to get a depth of 1000 feet one must go west of St. Kilda and Ireland, beyond the 100-fathoms line in the Atlantic ocean. There are no depths comparable to this in the North sea, but the submarine valley known as the "Norwegian Gut," which runs round the west and south coast of Norway, is remarkably deep, depths of 1794 feet (299 fathoms) and 1710 feet (285 fathoms) having been obtained at the part called "The Sleeve."

There are seven lakes on the continent of Europe which exceed Loch Morar in maximum depth, and in the following table their maximum depths, heights of the water surface above sea-level, and depths of their floors below sea-level, are shown as compared with Loch Morar. The first four of these lakes are in Norway, the other three are well-known Italian lakes.*

Name.	Max. depth.	Height above sea-level.	Depth below sea-level.
	Feet.	Feet.	Feet.
Hornisdalsvand	1594·5	167·3	1427·2
Mjösen	1482·9	396·9	1086·0
Salsvatn	1460·0	42·6	1417·4
Tinnsjö	1437·0	606·9	830·1
Como	1341·8	652·9	688·9
Maggiore	1220·4	472·4	748·0
Garda	1135·1	213·2	921·9
Morar	1017·0	30·5	986·5

The Lake of Geneva, in which very important and comprehensive limnological work has been done by Prof. Forel, Dr. Ed. Sarasin, and others, has a maximum depth of 1013·8 feet, and the height of the water surface is 1220·4 feet above sea-level; the deepest part of the lake-floor does not, therefore, go below sea-level, but lies at 206·6 feet above it.

Temperature Observations.—A large number of observations on the temperature of the water of Loch Morar have been made in various seasons and in different years. On April 29 and September 3, 1887, Sir John Murray took several series of temperatures, ranging from the surface to the bottom. In the April observations the temperature varied from 43°·9 at the surface to 42°·0 at the bottom, a range of 1°·9, and in September the variation was from 57°·8 at the surface to 42°·1 at the bottom, a range of 15°·7. On July 2 and 3, 1902, serial temperatures were taken by the Lake Survey, and the variation was from 55°·2 at the surface to 42°·2 at the bottom, a range of 13°·0. Subsequently, on March 28, 1903, the temperature was found to be practically uniform from the surface to the bottom at a depth of 1010 feet, the surface temperature being 41°·9, while that at the bottom was 41°·8, a range of only 0°·1, and on October 23 of the same year the variation was from 50°·2 at the surface to 43°·0 at the bottom in 1000 feet, a range of 7°·2. The temperature at the depth of 1000 feet has generally been regarded as fairly constant at about 42°·0 all the year round, with a variation of about 0°·2, and this higher record of 43°·0 may be due to the increased amount of water draining into the loch during the wet summer of 1903. The highest surface temperature recorded was one of 59°·2 on June 30, 1902, off Bracora, the air-temperature at the time being 62°·8, with a moderate westerly breeze. This gives a total range of 17°·4 between the highest surface and the lowest bottom temperature recorded.

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* The figures referring to these continental lakes are derived from "Halbfass, Die Morphometrie der Europäischen Seen," *Zeitschr. Gesellsch. Erdk. Berlin*, Jahrg. 1903, p. 592; 1904, p. 204.

FIG. 5.—FALLS OF MORAR.
(*Photo by T. N. Johnston.*)

TEMPERATURES RECORDED IN LOCH MORAR.

Date ...	29/4/87.	29/4/87.	29/4/87.	29/4/87.	29/4/87.	29/4/87.	29/4/87.	29/4/87.	29/4/87.	3/9/87	3/9/87	2/7/02	3/7/02	26/3/03	23/10/03	23/10/03	23/10/03
Position	South of islands near centre of west basin.	¾-mile E. of islands centre of loch.	Between Inverbeg and Letter-morar.	¼ mile W. of line between Brinacory island and Almhara.	About 1¼ miles E. of last position.	Little W. of line between Sword-land and mouth of Meoble R.	1 mile E. of Tarbet, centre of loch.	Within 1 mile of east end of loch.	Between Tarbet Point and Cruch Dubh au Rindhe Fheáne.	Off Tarbet, nearly halfway across.	Off Tarbet.	Off Wester Sword-land.	E. of islands.	Off Meoble	Off Meoble	Off Roma-saig.	Off Letter-morar.
Hour ...	8.45 a m.	9.10 a.m.	9.45 a.m.	—	10.55 a.m.	11.30 a.m.	12.30 p.m.	2.50 p.m.	4.30 p.m.	9.5 a.m.	—	6 p.m.	8 a.m.	10.30 a.m.	1 p.m.	2.30 p.m.	4 p.m.
Wind ...	E. 2.	E. 3.	E. 3.	E. 2.	E. 3.	E. 3.	E. 3.	E. 2.	E. 1.	W. 3.	—	—	S. light.	S.E. fresh.	N.W. moderate.	N.W. strong.	N.W. moderate.
Temp. of air	—	—	—	—	—	—	—	—	—	—	—	55°·2	55°·0	41°·5	50°·0	49°·5	49°·5
Depth.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.
0 ft.	43·1	42·9	43·1	—	—	—	43·4	43·9	43·5	57·8	—	55·2	54·6	41·9	50·2	50·2	50·0
5	—	—	—	—	—	—	—	—	—	—	—	—	54·6	—	—	—	—
6	—	—	—	43·4	43·8	43·1	43·5	—	43·3	—	—	—	—	—	—	—	—
10	—	—	—	—	—	—	—	—	—	—	—	54·5	54·7	—	—	—	—
18	—	—	—	—	—	—	—	43·7	43·1	—	—	—	—	—	—	—	—
20	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
30	—	—	—	—	—	—	—	43·5	—	57·9	—	—	53·0	—	—	—	—
48	42·9	—	—	—	—	—	—	—	—	58·0	—	—	—	—	—	—	—
50	—	—	—	—	—	—	—	—	—	—	—	51·6	50·5	—	50·0	—	—
60	—	42·6	—	—	—	—	—	43·0	43·0	57·6	57·8	49·1	—	—	—	—	—
75	—	—	—	—	—	—	—	—	—	—	—	48·0	—	—	—	—	—
78	—	—	—	—	—	—	—	—	—	57·6	—	—	—	—	—	—	—
90	—	—	—	—	—	—	—	42·6	—	51·0	52·0	—	—	—	—	—	—
100	—	—	—	—	—	—	—	—	—	—	—	47·0	47·3	41·9	50·0	50·0	50·0
108	—	—	—	—	—	—	—	—	—	52·1	—	—	—	—	—	—	—
120	—	42·3	—	—	—	—	—	42·3	43·0	46·8	47·0	—	—	—	—	—	—
150	—	—	—	—	—	—	—	—	—	54·3	45·6	45·0	—	—	—	—	—
162	—	—	—	—	—	—	—	—	—	—	44·8	—	—	—	—	—	—

180	—	42·3	—	—	—	—	—	42·2	42·8	44·0	44·2	—	—	—	—	—	—
198	42·2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
200	—	—	—	—	—	—	—	—	—	—	—	—	44·2	41·9	46·9	49·0	47·0
210	—	—	—	—	—	—	—	—	—	44·4	—	—	—	—	—	—	—
222	—	—	—	—	—	—	—	42·0	—	—	—	—	—	—	—	—	—
240	—	—	—	—	—	—	—	—	—	43·6	—	—	—	—	—	—	—
250	—	—	—	—	—	—	—	—	—	—	—	43·3	—	—	—	—	—
282	—	—	—	—	—	—	—	42·1	—	—	—	—	—	—	—	—	—
300	—	—	—	—	—	—	—	—	—	42·7	—	—	43·1	—	43·7	44·0	43·5
342	—	—	—	—	—	—	42·0	42·1	—	—	—	—	—	—	—	—	—
360	—	—	—	—	—	—	—	—	—	42·6	—	—	—	—	—	—	—
372	—	42·1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
400	—	—	—	—	—	—	—	—	—	—	—	—	42·6	—	43·2	—	43·0
420	—	—	—	42·1	—	—	—	—	42·1	42·3	—	—	—	—	—	—	—
468	—	—	42·1	—	—	—	—	—	—	—	—	—	—	—	—	—	—
480	—	42·0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
500	—	—	—	—	—	—	—	—	—	—	—	42·3	42·4	41·8	43·0	43·0	43·0
540	—	—	—	—	—	—	—	—	—	42·4	—	—	—	—	—	—	—
600	—	—	—	—	42·0	—	—	—	—	42·3	—	—	42·3	—	—	—	—
660	—	—	—	42·0	—	—	—	—	—	42·3	—	—	—	—	—	—	—
700	—	—	42·0	—	—	—	—	—	—	—	—	—	—	—	—	—	43·0
720	—	—	—	—	—	—	—	—	—	42·5	—	—	—	—	—	—	—
750	—	—	—	—	—	42·0	—	—	—	—	—	—	—	—	—	—	—
780	—	—	—	—	—	—	—	—	—	42·3	—	—	—	—	—	—	—
800	—	—	—	—	—	—	—	—	—	—	—	42·2	—	41·8	43·0	43·0	—
846	—	—	—	—	—	—	—	—	—	42·2	—	—	—	—	—	—	—
900	—	—	—	—	42·0	—	—	—	—	—	—	—	—	41·8	—	—	—
906	—	—	—	—	—	—	—	—	—	42·4	—	—	—	—	—	—	—
966	—	—	—	—	—	—	42·2	—	—	42·1	—	—	—	—	—	—	—
990	—	—	—	—	—	42·0	—	—	—	—	—	—	—	—	—	—	—
1000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	43·0	—	—
1010	—	—	—	—	—	—	—	—	—	—	—	—	—	41·8	—	—	—
1020	—	—	—	—	—	—	—	—	42·0	—	—	—	—	—	—	—	—

The deposits covering the floor of Loch Morar are mostly dark brown in colour, which becomes almost black in the deeper parts. A sample from 1000 feet was dark brown when wet, and greyish-black when dry, containing about 50 per cent. of black vegetable matter, about 10 per cent. of mineral particles (quartz, mica, hornblende, etc.), with a mean diameter of 0·15 millimetre, and about 40 per cent. of amorphous clayey matter, with many fine Diatoms and a few fragments of arenaceous Foraminifera. The mica is present in extremely minute flakes, and imperceptible to the naked eye in the unwashed material. In this respect the material from Loch Morar differs from that obtained in most of the other lochs, in the samples from which the glistening mica flakes attract one's attention.

Loch Beoraid (see Plate II.).—Loch Beoraid is a long narrow loch, lying amidst wild and rocky scenery about 3 miles to the south of Loch Morar. There were no Ordnance Survey bench-marks available in the vicinity of the loch from which the level of the water surface could be ascertained, but from the position of the spot-levels, the height was estimated at 168 feet above the sea. The loch trends in an east-to-west direction, and is fed by numerous small burns, the largest, Allt a Ghlinne Dhuinn, flowing in at the east end. The Meoble river, which drains the loch, issues at the west end, and, after a course of 3 miles, falls into Loch Morar. There are one or two small islands at the east end of the loch, and one large one lying in the centre, almost equidistant from both ends of the loch. The length of Loch Beoraid is 3½ miles, and its maximum breadth about one-third of a mile; the mean breadth is one-sixth of a mile, and the area covered by water is 352 acres, or over half a square mile. The number of soundings taken was 120, the maximum depth obtained being 159 feet; the mean depth is over 72 feet. The volume of water is estimated at 1,156,000,000 cubic feet, and the drainage area extends to 7680 acres, or nearly 12 square miles.

There are two basins over 100 feet in depth; one at the west end of the loch three-quarters of a mile in length, with a maximum breadth of one-sixth of a mile, approaching to within one-eighth of a mile from that end. The maximum depth obtained in it was 147 feet, comparatively very near the outflow. The eastern basin is nearly 1¼ miles in length, with a maximum depth of 159 feet, the area over 150 feet in depth being almost half a mile in length. The 50-feet area is continuous from end to end, passing to the south of the large central island, the depth in the channel being 53 feet. Loch Beoraid is a rock basin divided into two separate basins by a rocky ridge which crosses the loch at the large island. At the west end of the loch there is a rocky barrier, and the river Meoble in its course forms a waterfall over rocks a short distance from its exit. The loch was surveyed on July 1, 1902, by Messrs. J. Hewitt and James Murray, and at 4.30 p.m. on that date the following series of temperatures was taken about a quarter of a mile from the west end of the loch:—

Depth.	Temperature.
Surface	60°·0 Fahr.
10 feet	59·8 „
25 „	53·9 „
50 „	51·0 „
100 „	47·5 „
140 „	48·0 „

These temperatures show a range of 12°·5 from the surface to 100 feet, with a small inversion of half a degree between 100 and 140 feet. About 3 p.m. the surface temperature in the centre of the loch, half a mile from the east end, with a strong westerly breeze blowing, was found to be 61°·4.

Loch an Nostarie (see Plate III.).—Loch an Nostarie is a small loch lying about a mile to the north of the west end of Loch Morar, into which it drains through the little Loch a' Bhada Dharaich and the Allt an Lòin. It was surveyed on July 16, 1902, by Mr. Hewitt, when, by levelling from an Ordnance Survey bench-mark, the level of the water surface was found to be 89·3 feet above sea-level. The loch has a length of a little over half a mile, with a maximum breadth of nearly half a mile, the mean breadth being a quarter of a mile. The area covered by water extends to 90 acres, or nearly one-seventh of a square mile. The number of soundings taken was 62, the maximum depth being 35 feet, while the mean depth is very nearly 11 feet. The volume of water contained in the loch is estimated at 44,000,000 cubic feet, and the drainage area extends to 1152 acres or 1¾ square miles. The loch is quite simple in conformation, the deep water occupying a central position. On the date of the survey the temperature of the water was found to be almost uniform from surface to bottom, the difference between the surface temperature and that at 30 feet being only 0°·1 Fahr., as shown by the following series taken at 4 p.m. in the deepest part of the loch:—

Depth.	Temperature.
Surface	59°·3 Fahr.
10 feet	59°·3 „
20 „	59°·2 „
30 „	59°·2 „

The details regarding the lochs dealt with in this paper are given in the table on p. 78.

NOTES ON THE BIOLOGY OF LOCH MORAR.

By JAMES MURRAY.

Salmon, sea-trout, and loch-trout abound in Loch Morar, and the sport is frequently very good, but the salmon as a rule are "dour" to rise. Charr and the powan, or fresh-water herring (*Coregonus*), are said to inhabit the loch.

The biology of Loch Morar offers several peculiarities as compared with most of the other large Scottish lochs. The quantity of plankton is small, the larger

Loch.	Height above sea. Feet.	Number of soundings.	Length in miles.	Breadth in miles.		Mean breadth per cent. of length.	Depth.			Ratio of depth to length.		Volume in millions cubic feet.	Area of Loch. Square miles.	Drainage area.	
				Max.	Mean.		Max. Feet.	Mean. Feet.	Mean per cent. of max.	Max.	Mean.			Total in square miles.	Ratio to area of loch.
Morar	30·5	1102	11·68	1·60	0·88	7·53	1017	284·0	27·9	61	217	81,486	10·30	65·63	6·37
Beoraid	168·0	120	3·43	0·32	0·16	4·70	159	72·3	45·5	114	250	1156	0·55	11·85	21·54
Nostarie	89·3	62	0·56	0·48	0·25	44·60	35	10·95	31·3	84	270	44	0·14	1·79	12·78
		1284										82,686	10·99	65·63 *	6·0

* The drainage area of Morar includes those of Beoraid and Nostarie.

Entomostraca especially being deficient. With this is correlated an unusual clearness of the water (a white disc was visible in June at a depth of 42 feet). The plankton hardly varies throughout the year, except that *Leptodora*, *Bythotrephes*, *Holopedium*, and a few other genera appear in the summer months only. The quantity was slightly greater in March than at other seasons. At no season has *Daphnia* been observed in the loch, and its absence has also been noted by Dr. Thomas Scott (as long ago as 1892) and by Mr. D. J. Scourfield. This is more remarkable as *Daphnia* abounds in Loch an Nostarie, about a mile distant, and discharging into Loch Morar by a considerable stream. The only *Diaptomus* was the common *D. gracilis*; while many of the other large lochs in about the same latitude have also one or other of that group of closely related species represented in Loch Ness by *D. laticeps*. The *Bosmina* was the typical *B. longispina*, and not *B. obtusirostris*, which is the common species in the majority of the Scottish lochs. In contradistinction to the scarcity of larger organisms, many very small species were abundant. Desmids especially, of a few species, were unusually numerous in the plankton at all seasons. A remarkable variety of *Xanthidium subhastiferum* has been described by Messrs. West from material collected by the Lake Survey. In this the two spines of each side of the semi-cell, instead of lying in the same plane as the semi-cell, are placed side by side on the external angles of the wedge-shaped semi-cell.

The aquatic plants, growing in the shallow water among the islands, yielded an abundant fauna of microscopic animals, especially of Rotifera and Tardigrada. From among these there will shortly be described two new species of Bdelloid Rotifers. A new water-bear of the genus *Echiniscus* will also be described. It is distinguished chiefly by having the dorsal plates covered by a large hexagonal reticulation in addition to the usual dots. This species was very numerous in October, and has not yet been met with elsewhere.

ADMIRALTY SURVEYS DURING THE YEAR 1903.

By Admiral Sir W. J. L. WHARTON, K.C.B., F.R.S., Hydrographer.

UNDER the orders of the Lords Commissioners of the Admiralty, eight of His Majesty's vessels, with three small hired steam-vessels, manned by 78 officers and 703 men, have been employed on hydrographical surveys on the home and foreign stations. The following is a brief summary of the work accomplished, as detailed in the report prepared for presentation to Parliament:—

Reports of 344 rocks and shoals which were dangerous to navigation have been received at the Hydrographic Department, and were notified to the public by Notices to Mariners; 627 miles of coast have been charted, and an area of 20,467 square miles has been sounded.

In *Great Britain* various resurveys were made.

In *England*, at Portsmouth and Plymouth much close resurveying was done. At Dover a close re-examination was made of the soundings in the bay, with careful observations of the tidal streams, with a view to ascertaining if the progress of the harbour works had any influence on their set. Various re-examinations in the ever-changing Thames estuary were carried out. East Dudgeon shoal and Triton knoll were examined; the former has extended, and was traced as a ridge until it joins the Dudgeon shoal.

Tidal observations by means of a newly invented pneumatic tide apparatus were obtained in the North sea. Very fairly marked tidal curves were obtained on Brown ridge, Swarte bank, and Dogger bank. The curve on Brown ridge verified an observation made by Captain Hewett, R.N., in 1840—that in this position the vertical movement of the tide is only about 2 feet. On all the banks the range was less than on the nearest shore. It is hoped that these observations may be extended in future years.

Looe and Teignmouth were resurveyed. At the latter place the depths on the bar vary with every breeze of wind. Padstow was surveyed, and great changes were found in the banks and channels. Two shoal places were found nearly a mile south of the Dodman, which enforces the need of closer surveys than have hitherto been made.

In *Scotland*, Loch Eriboll and Gair loch were surveyed, and Stornoway (partly). In Moray firth the survey was continued from Burgh head, and completed as far as Buckie, besides large-scale plans of Hopeman, Lossiemouth, and Buckie (partly). At East Loch Roag further observations were made of the interesting magnetic shoal.

In *Ireland*, Queenstown survey was completed. Crookhaven was surveyed, and numerous shoals were discovered in Ballydivlin bay. Youghal harbour survey was taken in hand, and will be finished next year.

In *Newfoundland*, the survey of the bay of Exploits was continued, and a portion between Northern arm and Bay point on the west, and Burnt arm and Brown arm on the east was finished. A series of soundings immediately off the eastern approach to Belle Isle strait and in the outer part of the approach was obtained, which will aid vessels in finding their position in a fog.

An unexpected bank was found in the centre line of approach, which will create anxiety if struck by the lead, as it will appear as if the ship is near the shore.

In *British Columbia*, soundings were obtained in the approaches to the Strait of Juan de Fuca, completing the work carried out in the two previous seasons. The survey on the south-east coast of Vancouver island between Sidney and Cadboro' point was finished. The survey of the North channel to Queen Charlotte's sound was nearly finished, and plans were made of Blunden harbour and the Southgate group of islands. The survey of Nanoose bay was also begun.

On the *West Coast of Africa*, Old Calabar river and its approaches were surveyed, and a plan made of Duke Town anchorage. Observations were obtained in the strength of the Guinea current to ascertain its depth. It appears not to reach below 45 fathoms, diminishing to 15 fathoms as the shore is approached. A shoal off the Bissagos islands, in the main line of traffic to the Cape Colony, reported by the s.s. *Ruapehu*, was searched for without success, and has now been removed from the charts.

In the *China seas* two ships were at work. The West Lamma channel at Hong Kong and a portion of the waters from Putoi islands to the westward were surveyed. The survey of Mirs bay near Hong Kong was continued. The survey of the British sphere of influence on the Shantung coast was resumed, and the portion from 3¼ miles east of Kimin island round the promontory to 1 mile south of Ears rock was finished, and plans were made of Actæon and Swallow coves, as well as of Rocky, Litau, and Aylen bays. 3910 miles of soundings were obtained on the outer part of the great bank which stretches off the coast to the north of the island Shaweishan, at the mouth of the Yangtse, without any dangers being discovered.

In *Australasia*, on the east coast of North island, New Zealand, 115 miles of coast-line has been surveyed from Te Para to East Cape, and soundings were obtained over an area of 1370 square miles in the vicinity of the coast. The entrance channel to Port Nicholson was surveyed. The survey of the east coast of North island from Cape Runaway to the southward is now in hand. During the search for a 5-fathom shoal, reported by the *Star of Bengal* situated in the open Pacific, 410 miles N. 50° E. from Auckland, an extensive submerged ridge 27 miles long was found to have depths over it from 300 to 100 fathoms, coral. The frequent rips which were seen on this ridge may have given rise to the reported shoal. In Tasmania, Hunter passage on the north-west coast was surveyed, assistance being obtained from the Tasmanian Land Office. A portion of the inner route to Torres strait was surveyed to the southward of Cook town, between Monk House and Rattlesnake points, including a part of the passage to the outer barrier reef.

The surveying ships maintained by the *Indian Government* continued the survey from Chittagong to the southward on the Arakan coast, and a plan was made of Naaf river. At the Andaman islands plans were made of Port Meadows and Kotara harbour. A survey of Mayu is in progress, and on the Tenasserim coast the entrance and approach of Henzé basin are also being surveyed.

During 1903 the Hydrographic Department has published 144 charts and plans, and 48 new plans have been added to the existing plates. The number of charts printed to meet demands has, during the year, amounted to 520,898.

REVIEWS.

EUROPE.

CVIJIĆ'S GEOLOGICAL ATLAS OF MACEDONIA AND OLD SERVIA.

'Geologischer Atlas von Makedonien und Altserbien.' Von Jovan Cvijić. 8 Blätter in Imperial-Format. Lithog. der Staatsdruckerei.—Ausgabe der Akademie der Wissenschaften. Belgrade, 1903.

FOLLOWING on the large limnological atlas of last year, there now comes this no less valuable carthographic work, embodying, in eight large sheets, the geological researches of the Servian scholar in fields of such manifold present interest. Two of the maps are already known in the inner circles of specialists, as supplements to the official reports of the Vienna Academy. Here new light is shed on them by the six complementary cartographical sheets. The two in question are the "tectonic" maps (1:1,200,000): one, of the frontier territory between the so-called "ancient mass" and the younger Dinaric and Albano-Greek folds; the other, of the Dinaro-Albanian *Scharung*.

They have already been noticed in this *Journal* (June, 1902, pp. 735–737) in a manner appreciative of their importance. To the geologist, and no less to the geographer with a previous geological training, the most important sheet in the whole work now completed will be the geological map of the entire territory on the large scale of 1:500,000. A comparison with hitherto existing representations of the geological formations around the Dessaretic lakes, and in the Vardar and Struma valleys, illustrates for the first time the scope and value of the progress towards a knowledge of these lands attained through the investigations of the Servian scholar. The variously coloured print brings out in clear and distinct discrimination geological structures of twenty-two different ages and characters. They are described in Servian and French. Among them the geographer will particularly prize the detailed subdivision of the alluvial deposits, as the strata immediately preceding our era. Cvijić here distinguishes "Calcaires lacustres," "Tufs calcaires," "moraines," and "sédiments fluvio-glaciaires." Three sheets with fifteen geological profiles supply, in vertical section, the necessary complement to this ground-plan and the data necessary to a thorough interpretation of the folding and deposition, the dislocations and basin-formations of the land. Most of the profiles are on the scale of 1 : 200,000, with five-fold vertical exaggeration; several on the scale of 1 : 100,000. The detached eastern section "From Kilia on the Black Sea to the Bosphorus" is on the scale of 1 : 50,000. The very complete definition of the strata by symbols indicates the species of rock; the colour, in harmony with the map; and the formation. The description is in Servian and German.

Of especial interest to geographers and cartographers is the large sheet devoted to the history of the development of the cartographical representation of the Balkan peninsula. It contains twelve facsimilies of general maps, ranging from Abraham Ortelius (sixteenth century) down to the one in Stieler's Hand-atlas, dating from the middle of the nineteenth century. Besides the above, maps interesting on account of their authorship are those of Sanson (1692) and of Buache (1744). They well illustrate the tenacity of the geographical conception that the Dinaric range (in Croatia and Bosnia), the Sardagh in Old Servia, and the Balkan (in Bulgaria) constituted one continuous mountain chain. A small map giving a synopsis of the learned author's travels forms the conclusion of the important work, the accompanying text of which is likewise in part being set up in type.

THE NEAREST EAST—TWO POINTS OF VIEW.

'Through the Lands of the Serb.' By Mary E. Durham. Edward Arnold. 1904. Pp. ix., 345. *With a Map.*

'The Balkans from Within.' By Reginald Wyon. Finch & Co. 1904. Pp. xviii., 475. *With Two Maps.*

The scope of these two admirable volumes is not wholly the same; their purposes are wholly dissimilar. Yet inasmuch as from the geographical standpoint they have the same interest, it is justifiable and instructive to consider them together. Mr. Wyon covers the whole ground from the Golden Horn to the Montenegrin border; he travelled, under the fullest protection that could be afforded him, as a correspondent; those responsible for his safety in the several countries he visited having the proper conception of the value of a hair of his head. Miss Durham, on the other hand, adventured herself in Servia and Montenegro, and even Albania, trusting to her sex and to the application of the proverbial *noblesse oblige.* In part of her travels, moreover, ignorance was bliss; for there can be no doubt that she adventured more dangerously than she knew. Certainly the woman traveller was accepted where no ordinary male would have made his way unscathed. Her journey as such is the more praiseworthy.

Mr. Wyon was, of course, intent on bloodshed, on wars and rumours of wars; and though in his series of vivid sketches of things seen the political aspect of his subject is not often insisted upon, it is always present to the mind. Nor is this aspect wholly neglected by Miss Durham. Setting aside political considerations, so to write, in the concrete form, a question of abstract political geography is forced upon the imagination by both these books. We see in the mind's eye the tourist who would become a traveller casting all his ambitions from him as he tries to enter Belgrade in the same casual manner in which he would alight at the Gare du Nord. The line of demarcation here, between the West and the nearest East, is the most remarkable unnatural line which the political geographer has to draw. Under different conditions (say, the existence of a strong coherent power in Greece) it would never have been drawn. But being drawn, it preserves, and will long preserve (to judge from the books before us), this wonderful picture of races in infancy —of men who are of full age in childhood and children in manhood, whose abstract gods are friendship and enmity. We find Mr. Wyon writing of "a European" as distinct from the native of this region. It is to him, the native, that both writers devote their chief attention, viewing them under opposite conditions, but arriving at precisely similar conclusions. The geographical interest of both books centres upon the Albanian and the Montenegrin.

The volumes are well illustrated, but the illustrations, like the text, are concerned with the people rather than the physical attributes of the country. Both, however, have a few striking word-pictures of the little-known scenic wonders of the region; and how far the travellers were at times fulfilling the *rôle* of explorers may be gathered from the frequency with which they were dependent for knowledge of a journey's length on the native estimate in hours, which generally sadly overestimated the capacity of the foreigner. Mr. Wyon was once wholly lost in the Rilo mountains. Miss Durham's excellent descriptions of the towns she visited, and her archæological notes and drawings, are noteworthy features of her work.

O. J. R. H.

ASIA.

PERSIAN ORNITHOLOGY.

'The Birds of Eastern Persia: Ornithological Results of an Excursion made in 1898.' By G. N. Zarudnyi. St. Petersburg: 1903. (Memoirs of the Russian Geographical Society, for General Geography, vol. xxxvi. part 2; Russian.)

The geographical portion of this journey was described in the first part of the same volume of the 'Memoirs,' as well as in a communication to the Memoirs of the St. Petersburg Academy of Sciences (x., No. 1); while the birds of the Transcaspian region were described by the same author in 'Materials for the Knowledge of the Flora and the Fauna of Russia,' part ii. In the present work the learned ornithologist gives the description of the species of birds which he met, and of which he brought specimens. Only a few species have been added on the authority of Dr. Blanford ('Eastern Persia,' vol. ii.) and Dr. Aitchison ('The Zoology of the Afghan Delimitation Commission'). N. Zarudnyi considers that it would be premature to draw any general conclusions concerning the bird fauna of Persia, in connection with other portions of the Iran plateau and the Turan lowlands, so long as large portions of Afghanistan and Central Persia remain unexplored; he therefore simply describes the 421 species of birds which are known from Eastern Persia, giving notes about their habits and the localities they were found in, and showing their distribution over six districts, into which he subdivides Eastern Persia.

KOREA.

'Korea.' By Angus Hamilton. London: Heinemann. 1904.

This is a book full of interest. The journeys made by the author include a trip to the German mines at Tongkoku, and another to the Diamond mountains, of which Mrs. Bishop has written an earlier description, and add but little to our geographical knowledge of Korea. But the charm of the book lies especially in the freshness of treatment and fulness of detail with which each subject is presented, and in the opportune information regarding the political situation in Korea almost up to the date of the outbreak of the war between Russia and Japan. The varying influence of Russia and Japan, the absence of British traders (though British manufactures had through Japanese pedlars secured a commanding position before Korea was opened by treaty to trade), the value of the harbours, the beauty of the land, and the love of its people for natural beauties, are each in turn represented by a happy pen supported by excellent illustrations. At the same time there is much information regarding the peculiar customs of the country and the progress of foreign trade, especially at Chemulpo. An account is given of the various foreign mining enterprises, and in the appendix are full tables of statistics of trade.

Mr. Hamilton is justly eloquent on the good work done by Mr. J. McLeavy Brown, C.M.G., the Inspector-General of Customs, and writes very interestingly on the present queen and the minister, Yi Yong-ik, whose rise from the lowest condition to the highest influence has been attended with vicissitudes the tale of which was not completed at the date of the volume. Some of the generalizations drawn by the author are doubtless at variance with the opinions of men who have lived longer in the country, but the picture of Korea at the close of 1900, and the history of the opposing interests of different nations, are attractively portrayed. One of the best portions of the book is the preface, which contains an excellent description of that part of Manchuria which is now the present scene of the war, together with particulars of the relative strength at sea and on land of the two nations then making ready for battle. W. R. C.

JAPAN.

'Impressions of Japan.' By G. H. Rittner. John Murray. 1904. Pp. xii., 223.
'Japan and Her People.' By Anna C. Hartshorne. Kegan Paul. 1904. In two volumes, encased. Pp. x., 377; vi., 374. *With a Map.*
'Japan: Das Land der Aufgehenden Sonne.' By Dr. Joseph Lauterer. Spamer, Leipzig. Pp. v., 407.

If these three works may be taken as an average of those called forth by present happenings, the comparison of treatment is not without interest. For here we have Japan as it impressed an Englishman and an American woman, and as a German has studied it. Mr. Rittner's work consists of a series of sketches on disconnected subjects, pleasantly written, and beautifully illustrated. Miss Hartshorne's book is on similar lines. A reader would find ample entertainment in either, even one who did not know where Japan is. Like the generality of books of "impressions," information as to the natural appearance of Japan practically confines itself to the two themes—the flowers and Fujiyama. In effect, both works should commend themselves to the casual traveller as efficient adjuncts to Murray's Handbook; and this is meant in no derogatory sense. Miss Hartshorne, for example, gives fragments of archæology and legend of high interest and erudition, but contrast what (it may be presumed) is demanded by the German reader. Dr. Lauterer's scientific study is veiled by an attempt, far less successful than the English, at picturesque binding, by photographs of scenery, geisha, and so forth; but in his first few pages is a chronological list of Japan's rulers from 660 B.C. He works through the entire history of Japan from that date until the present day, dividing it into eight periods. Philology, art, conditions of life, topography, geology, climatology, botany, flora, fauna, and a list of authorities—these subjects are handled in succession, and well handled; but the result, to be frank, reads something like a magnified telegram. This is typical of the practical German outlook. In England we have it not. The German geographical method has developed beyond ours, but it is a question whether a system of geography which calls forth a book attempting to crystallize all the conceivably kindred sciences, does not defeat its own ends by giving up all its claim to originality. O. J. R. H.

A JOURNEY ACROSS SUMATRA.

'Quer Durch Sumatra.' By Alfred Maass. Berlin: W. Süsserott. 1904. Pp. xii., 143. *With Two Maps.*

This is an interesting account of a journey of some 250 miles across the south-east of Sumatra, between Bangkoelen on the west coast and Palembang on the east. The route taken led nearly north from the start into the highlands of Padang, mounting the coastal range of Barisan, which appears on this the steep side of the island. It then struck down on to one of the streams feeding the river Moesi, and followed that stream down to Palembang. The book is properly prefaced with a short account of the history and physical appearance of Sumatra. The descriptions of scenery and native life are excellent, and the illustrations apposite and well produced from photographs. Of particular interest are those which show the handsome and fantastic domestic architecture of the better class of dwellings.

AMERICA.

CANADA.

'Sport and Travel in the Northland of Canada.' By David T. Hanbury. Edward Arnold. 1904. Pp. xxxii., 319. *With Two Maps.*

This important work is decidedly mistitled, for the phrase "Sport and Travel" rather suggests a common type of travel-book, which simply relates acts, and has no scientific objective. On the contrary, Mr. Hanbury set out to explore, to collect new facts; and he fired his gun and drew his net less often as a sportsman than as a hunter by necessity. Nor was his work, as here set forth, topographical only. He brought home geological, faunal, and floral collections, with meteorological and ethnological data, to which reference must be made later. The course of his journey of 1901–2, to which previous journeys are here treated as merely introductory, was detailed in the *Journal* of December, 1902 (p. 655), and February, 1903 (p. 189); it will therefore suffice to indicate here that it led, roughly speaking, from Chesterfield inlet to the Arctic coast in 101° W., and along the coast (crossing Kent peninsula at its neck) to the mouth of the Coppermine river, and so by Great Bear lake to Fort Norman on the Mackenzie. He broke new ground in local journeys north of Chesterfield inlet and Baker lake, and, on his main route, from the point where he left the Ark-i-Linik river and crossed the height of land on his way to the coast. From here he descended Buchanan river through slightly undulating open country to Backs river and Lake Pelly (260 feet above sea-level), and continued thence northward through a very barren and rocky district. On the coastal journey the old surveys were found generally accurate, save that by crossing Kent peninsula instead of skirting round it, Mr. Hanbury found that large mass of land to be much more nearly insulated than was previously supposed, owing to the existence of a narrow-mouthed inlet, which had been missed by the coast surveyors. Having regard to the nature of the country traversed, it might have been well if Mr. Hanbury's route surveys on the newly explored portions of his journey could have been exhibited in greater detail, as the small scale of the topographical map provided does not enable the reader to follow the narrative closely upon it. Without this assistance it is not easy to appreciate in detail the physical characteristics of the land from the text, for these are never strongly marked individually. The land is one in which cartography could make clear much that neither verbal description nor photography can touch. The result is that the narrative in parts becomes little more than a diary of events, and somewhat lacks variety. But there is a general impression that, in writing, Mr. Hanbury minimizes his difficulties, and that therefore he is entitled to even greater credit than appears at first glance for the excellent scientific work set forth in a series of appendices. As regards geology, Mr. Hanbury gives a synopsis of his observations, and Dr. J. S. Flett, F.G.S., identifies twenty-one rock specimens. There is, moreover, a geological map. In this connection, it may be noted that Mr. Hanbury collected ample proof of the richness of the copper deposits of the Arctic coast. Thus some natives met near the Fitzgerald islands, east of Kent peninsula, were rich in copper implements, and stated that some of their copper was obtained in Victoria Land across the strait, and some from the islands to the north; and the travellers found quantities at Lewis island in Bathurst inlet. An admirable coloured plate is provided to show the butterflies collected; while Mr. H. J. Elwes, F.R.S., who scientifically describes the specimens, states that "it is the most interesting collection I have yet seen," and that, "considering the difficulties under which collecting is carried on in such a region, and that Mr. Hanbury had not previously any experience in collecting, this collection does him the highest credit. Mr. R. A. Rolfe tabulates the botanical collection. A daily series of meteorological observations is given from September 22, 1901, to September 23. 1902, with wind and weather notes, and an almost complete list of maximum and minimum shade temperatures, which should be of the utmost value. Finally, there are measurements of a few Hudson bay and Arctic coast Eskimo, and an Eskimo vocabulary. A feature of the journey was the remarkably amicable relations between Mr. Hanbury and the Eskimo employed and encountered by him, and he has nothing but praise for them, contrasting their character strongly and very favourably with the Indians.

Lastly, an unscientific word may be allowed as regards the use of Eskimo geographical names. Mr. Hanbury is in favour of their retention, and this is in accordance with rightly recognized usage at the present day. But as regards the larger physical features of Northern Canada, and not a few of the smaller, previous explorers have not observed this. The giving of English names has gone so far as to suggest an argument against the present accepted custom, and the political status of the country might be adduced in support. Eskimo names are particularly unfamiliar and (if constantly hyphenated) unwieldy. Moreover, they make for additional chaos in geographical spelling—a chaos from which the map accompanying this volume has not been saved, so that there is the usual regrettable lack of uniformity in some cases. O. J. R. H.

The Orinoco Valley.

'A Naturalist in the Guianas.' By Eugène André, F.R.G.S. London: Smith, Elder & Co. 1904.

Few of the unexplored areas of South America possess greater attractions for the intrepid traveller than the one enclosed on the north and west by the river Orinoco, and on the south by the low Pacarima range of mountains, the eastern extension of which terminates at the mysterious dome of the demon-guarded Roraima, on the southern boundary of British Guiana. In the days when the Spanish *conquistador* inflamed the imagination of Europe with stories of a golden empire, accessible by the rivers of the region outlined, Ralegh sought for Manoa by the way of the Orinoco and Caura, and promised that "whatsoever Prince shall possess it, that Prince shall be Lorde of more Gold, and of a more beautifull Empire, and of more Cities and people, than eyther the king of Spayne, or the great Turke."

The Caura tributary of the Orinoco and its picturesque valley has recently been the field of the labours and perilous adventures which Mr. André vividly describes in the interesting volume under review. He gives the river a length of about 500 miles, and tells us that from the Waiomgomo indian settlement, at its source, to the rapids of Mura, 400 miles down-stream, no human habitation is met. The whole distance is nothing but a wilderness and an interminable forest; but on the lower river there are extensive *llanos* diversified by narrow belts of woodland bordering the streams or pools of water. The whole forested region, especially during the rainy season, is infested by myriads of flies and clouds of gnats and mosquitoes. Immense flocks of cormorants are occasionally seen, and their repulsive and oily flesh sometimes serves as food for the people of the lower Caura.

Butterflies, nightjars, hawks, rice-birds, curassows, and trojons attract the facile pen of Mr. André and add to the charm of his book, while his remarks upon ants remind us of Belt's 'Naturalist in Nicaragua.' Pumas, tapirs, capabaras, and peccaries represent the larger forms of animal life, but are seldom met. The river abounds in fish; and alligators, electric eels, and caribes enliven its waters.

In the lower river are the rapids of Mura and Piritu, but in its middle course is a succession of cataracts called the Falls of Para. Here the land rises abruptly, some 800 feet, to a plateau about 1000 feet above sea-level, which in turn gradually ascends to 2000 feet, to the base of the Pacarima range.

It is interesting to note that, in Spanish colonial days, a line of fortified posts was erected along a road which the Spaniards opened between Esmeralds, on the upper Orinoco, and the Caura, by way of the rivers Padamo and Erewato; but all of these strongholds were destroyed in 1776 by an uprising of the indians, driven to revolt by the cruelties inflicted upon them by the garrisons. This military cordon was supposed to prevent incursions of the Caribs, that warlike people of which Padre Cassani so bitterly complained in 1741, when giving an account of the Jesuit missions on the Orinoco.

With a poorly equipped expedition of fourteen men and three boats, Mr. André started from La Prision, on the lower Caura, to explore the stream to its source. The difficulties encountered were formidable—the dense forest through which the river coursed, the thick tangle of undergrowth on its margins, the cataracts, rapids, and other obstructions to navigation, the appalling hordes of ants and swarms of different kinds of flies, the lack of proper food, and the debilitating, sickly climate gave the voyage such a desperate character that, on reaching Mount Amélia, near the source of the river, our explorer was forced to turn back. His largest boat was wrecked soon after at the Arichi rapid, and all of his botanical specimens, seeds, insects, samples of rock, writing-case, and journals were lost. Provisions for eight or ten days alone remained, game was scarce and not to be counted upon, a vast uninhabited and inhospitable wilderness had to be traversed, and starvation sat grinning at him from his two remaining canoes. These being too small to carry the entire party, five of his men undertook to reach the settlements down stream by walking 200 miles through the forests—they were never heard from afterwards. The remaining nine members of the expedition descended the river in the canoes, but such were their sufferings on the way that one of them died of starvation.

The thrilling account which Mr. André gives of the voyage recalls the fearful losses by hunger and exposure of Lieut. Strain's party, some fifty years ago, in its attempt to cross the isthmus of Panamá by an unknown route.

The wreck of Mr. Andre's boat was a sad loss to science, but the brave explorer must be congratulated that, despite his mishap, he has been able to produce a record of his travels replete with valuable scientific and descriptive *data* which add greatly to our knowledge of an important section of the Orinoco valley. Dr. Keltie, in his admirable preface to the author's volume, justly says, "In no region of the world is travelling more full of incident, more prolific in perilous adventure, than in the dense tropical forests and along the mighty streams of the still practically virgin areas which form so large a part of the South American continent." G. E. C.

AMAZON TRIBUTARIES.

'Voyage au Rio Curua;' 'Voyage à la Mapuerá;' 'Voyage au Mayecurú.' Par Madame O. Coudreau. 3 vols. Paris: A. Lahure. 1903.

In the vicinity of Obidos, on the Amazon river, are three small streams entering the great fluvial artery from the north. Between 1900 and 1903, the venturesome widow of M. Henri Coudreau examined these, and the works above named are the records of her voyages and excursions. They give an entertaining account of her impressions, her local everyday experiences, comments on the Brazilians and the indians whom she met or had in her employ, and an occasional valuable remark upon the geography of the districts through which she travelled. With happy poetry and sentiment, she impresses her pages with the atmosphere of her surroundings, translates the reader to the dreamy groves of the margin of the Amazon, and lazily swings him in the *hamac* of her volubility.

Her works are profusely illustrated with vignettes, which are especially valuable as showing the character of the numberless cataracts and falls which obstruct the rivers she ascended. Each volume is accompanied by maps on a large scale, showing the courses of the streams and the very numerous impediments to their navigation. Altogether Madame Coudreau's chapters are pleasant reading, and one can but admire the ready wit, courage, and tact which enabled her to overcome any obstacle she encountered. G. E. C.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

GLACIERS.

'Die Gletscher.' By Dr. Hans Hess. Pp. xi., 426. Braunschweig: F. Vieweg und Sohn. 1904.

This handbook may be said to meet a long-felt want. It is now nearly twenty years since Prof. Heim published his 'Gletscherkunde,' and during the interval the advance of our knowledge of glaciers and all that relates to glaciation has been rapid. In Greenland, Alaska, Spitzbergen, and the Antarctic Regions, scientific travellers have investigated the operations of existing glaciers and ice-sheets, while geologists have brought to light many important facts regarding the history and subdivisions of the glacial period, and the existence of glacial deposits in the earlier formations. The time was evidently ripe for an up-to-date work which should summarize the results of the different lines of research, and Prof. Hess combines in himself many of the essential qualifications necessary for success in the task. He has produced a book which is clear and concise, and in which the different parts of the subject are treated of in sufficient detail for the purposes of the general reader, while he has not failed to consider the results of the latest investigations. The polemical aspects of the subject are not passed over, but are not allowed to dwarf the less-debated because well-established conclusions. As a scientific handbook this treatise deserves to be welcomed, if only because the writer has not hesitated to take up a strong position against many eminent authorities, where he thought the balance of evidence and the results of his own investigations were distinctly opposed to their views.

On the question of glacial erosion, with the attendant phenomena of overdeepening of valleys and formation of lake-basins, he is evidently a follower of Penck, Brückner, and Baltzer, and departs widely from the position of Heim. He considers ice a more powerful agent of erosion than running water, and is prepared even to assume that some glaciers may lower their beds at a rate of 2 or 3 centimetres a year under favourable circumstances. Whether this is not an extreme view time alone can tell, but it is, at any rate, refreshing to see these conclusions so confidently advanced in spite of the strong criticism which they have always provoked. The author also supports the opinion, which is now practically universally accepted by geologists, that the Ice Age included three or perhaps four distinct epochs of intense cold separated by intervals of warmer climate. Two more important problems, the cause of climatic changes and the mechanism of the flow of glaciers, he discusses more or less freely, but admits are not completely solved.

Useful tables of statistics are given regarding the advance and retreat of the Alpine glaciers during recent years. Though we miss the picturesqueness and individuality which makes Heim's book so attractive, this may be welcomed as the best and most complete recent work on the subject of which it treats.

J. S. F.

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

The Earth and Man.

'Geographische Kulturkunde.' By Leo Frobenius. With eighteen Plates and forty-three Sketch-maps in the Text. Leipzig: Frederich Brandstetter. 1904. Pp. xvi. and 924.

In an explanatory sub-title, Herr Frobenius tells us that this work is an exposition of the relations existing between the Earth and human culture as described by early and late observers, the practical object being to enliven geographical instruction in the schoolroom. For this purpose the plan adopted should prove successful, and in any case the book will be welcomed by those serious students who, not being specialists, still take an intelligent interest in the numerous questions concerned with the relations of man, and especially of the lower races, to their environment. There are the grassy plains and the nomads, exclaims the author, the fertile slopes and the husbandmen, the woodlands and the hunters, the fluvial waters and the canoe-men, the open seas and the seafarers; that is to say, men are what their surroundings have made them. And it is pointed out that their dependence on the physical conditions of their existence is in direct ratio to their social state. In other words, the ruder, the more primitive their institutions, the more influenced and controlled they are by the character of the regions in which they have grown up and slowly reached higher levels of civilization. Hence this civilization in all its phases is properly called "geographische Kulturkunde," which may, without too great straining, be literally rendered "geographical culture-lore."

It is a fine theme, certainly not new, yet of biding interest, and here systematically treated almost for the first time in a pleasant, attractive way. The author humorously compares himself to the orchestral "conductor," who summons the good and bad musicians, invites them to play their several parts, and controls the whole performance. Whoso wishes, he says, to hear the tuneful notes of the natural fiddle and the clash of all the instruments, must turn to the first section, which introduces the several chapters. These introductory sections are, so to say, the "printed programmes" handed round to the audience, who thus know what they have to expect, and will follow the performance with greater intelligence and enjoyment to the end.

The contents of chapter i. will make all this clear, and give the reader a fair idea of the general treatment. We have, first of all, the "programme," "Africa and the Africans," which is written by the "conductor," and gives a rapid *aperçu* of the physical and mental characters of the inhabitants of the continent, showing how everything harmonizes with its physiography, and illustrating the whole subject with several little inset maps and a full-page plate, exhibiting the more typical agricultural and other implements of the aborigines. Then follow the "selections" of the varied "programme," which of course constitute the great bulk of the volume. The first chapter leads off with the Negritos of the forest zone, the chief "musician" here being Sir H. M. Stanley. He is succeeded by Herbert Ward, Georg Schweinfurth, L. Wolf, Oscar Lenz, Max Buchner, and J. L. Wilson, to whom are severally assigned, "The Congo Peoples and their Pursuits;" "A First Visit to the Mangbattu King, Munza;" "A First Visit to the Bakuba Chief, Lukengo;" "Fetishism on the West Coast;" "The Duallas of the Kamerun;" and "The Tribal Organization of the Kru Negroes." The excellence of the performance is at once guaranteed by the names of these "skilful musicians," while the copious extracts from their "compositions" are supplemented, wherever necessary, by the author's explanatory remarks.

But the "execution" is, of course, not everywhere equally brilliant, and the critical ear seems here and there to detect a jarring note emitted by the "maestro" himself. Thus, in the preface we read of a nomad state which had acquired a wonderful development in South Africa amongst the "Reitervölker," who "von Asien aus weit über Afrika hin herrschen," but who certainly never came within thousands of miles of South Africa. This nomad state is elsewhere (p. 155) regarded as a degraded phase of a higher culture, "most nomads having formerly been agriculturists driven to the desert." I think it may be shown that the reverse is the case, and that the Semites, for instance, were *originally* nomads, who often overran the settled districts (Mauritania, Iberia), and reduced some of these districts (Mesopotamia) to a wilderness. In the same place the Tedas are called "Negroes." But, as shown by Nachtigal ('Sahara und Sudan,' vol. ii.), the Tedas are the northern and original section of the Tibus, who are not Negroes, but Hamites, akin to the neighbouring Berbers.

But such slips are not numerous, and the chief fault to be found with the book is its unwieldy size (940 pages), with no proper sectional divisions, no index, and a very poor table of contents. But no doubt the cost of production was in this instance a matter of serious consideration.

A. H. K.

GENERAL.

THE RECORD OF A SOLDIER.

'From Kabul to Kumassi.' By Brigadier-General Sir James Willcocks. John Murray. 1904. Pp. xvi., 440.

This is Sir James Willcocks' record—Afghan campaign, 1879; Waziri expedition, 1881; Soudan campaign, 1885; Burmah, 1885; Chin-Lushai expedition, 1889; Munipore expeditionary force, 1891; Tochi field force; West Africa. His book is the ideal of a soldier's autobiography. The story arrests attention from the moment when, with the brazen audacity of youth, he telegraphed to ask for a place in the forces for Afghanistan. He got it, just as he got the Distinguished Service Order and other rewards of bravery, though we are not told very much about them. But it is evident that his heart lies in his work in Africa. This has an additional interest, inasmuch as he left India to serve under, and at the special request of, Sir Frederick Lugard, of whose brilliant personality and services to the Empire we are told a great deal. Modesty is, therefore, one attribute of Sir James Willcocks' writing; another is simplicity. Political questions, apart from actual facts as he witnessed them, are happily ignored. His business is to tell only how a soldier has done and enjoyed his work, and his pleasure too, for he is a strenuous sportsman. There is something very attractive about this sequence of events in Borgu in 1898. Upon a day our troops are very nearly at grips with the French. At the last moment, when tension is just at the breaking-point, comes news of the Niger Convention. The French withdraw from Borgu, and Sir James goes off to shoot his first African antelope. As an author he is fortunate in his own story, for the climax comes dramatically at the end, with the relief, of course, of Kumassi. Any story with such a culmination must needs be of interest; in this author's hands it gains greatly from his ability to stage it fitly; throughout he depicts clearly, not his actions only, but the various stages on which he has acted, having the descriptive touch. His book is on all counts welcome.

O. J. R. H.

THE MONTHLY RECORD.

EUROPE.

The Limits of the Cotswolds.—Mr. S. S. Buckman has recently investigated this question, taking into account historical and local usage as well as physical characteristics. The following is his general definition of the Cotswolds or Cotteswold Hills. High ground mostly in Gloucestershire, bounded on the south-west by the vale of Berkeley, on the west by the vale of Gloucester, on the north-west and north by the vale of Evesham, on the north-east by the vale of the Red Horse, on the east by the vale of Moreton and the Evenlode valley, on the south-east by the vale of the White Horse, and on the south by the valley of the Bristol Avon. The western ridge is precipitous, and generally more than 700 feet at the southern end, to about 900 feet at the northern end above sea-level. Here a considerable area is over 1000 feet. Cleeve Hill, 1083 feet, is the highest point; Broadway Hill, 1048 feet, the next. The greatest length is 57 miles, greatest breadth from Standish Brawn to Wilcote is 35 miles. Outliers are Robin's Wood (Matson), Churchdown (Chosen), Dumbleton, Breden, etc. North of Stinchcombe Hill the trend is south-west to north-east, and south of it north to south. The Stroud valley has been usually taken to divide the Cotswolds into a north and a south part. Mr. Buckman, for geological reasons, divides them into three—(1) The South Cotswolds, extending along the valley of the Bath Avon to the vale of Stonehouse (Frome valley), the line following the road from Chalford to Siddington (Cirencester), and extending along the outcrop of Cornbrash; (2) the Middle Cotswolds, running to the Chelt valley, the road from Andoversford to Little Barrington, and the valley of Windrush; and (3) the North Cotswolds beyond this. The vale of Berkeley runs from Thornbury and Wilkmar in the south, and a line from Bredon Hill to Oxenton. South of it the plain has no special name. The vale of the Red Horse is the low-lying ground round the Stour valley, parting the north Cotswolds from Edge Hill range. The vale of Moreton, 400 feet above sea, extends from Moreton-in-the-Marsh to Shipton-under-Wychwood. The vale of Gawcombe may be given an offshoot opposite Chipping Norton. The vale of Bourton, an upland vale in the Cotswolds, is nearly 400 feet above sea, which almost breaks into foam near Stow. The vale of the White Horse he extends, on very doubtful grounds, to that of the upper Thames; but surely the line of heights from Farringdon to Oxford is sufficiently obvious to make it desirable, even if there were more evidence in favour of the extended signification than there is, to distinguish between the two. Mr. Buckman points out that use might be made of the local distinction between a "valley" (narrow) and a "vale" (broad), the latter generally associated with a place-name. The vale would be the equivalent of strath. The valley sides are called "banks," the floors "bottoms," and the aggraded floor of a dry valley is known as a "flat." "Combe" is applied to the narrow head of a valley. He also discusses the derivation of the word "Cotteswold" or "Cotswold," and decides it is from the Celtic "Coet y sellt" or "Coed y swl," the limit of the wood, or the wood of the plain, corrupted by Teutons into Catwald or Catteswald, hence Cotteswold, which he considers the best form. Mr. Buckman makes fun of Ritter's Geographical Statistical Lexicon for saying the Cotswolds are 6 miles long by 4 wide, but the translator of the piece has been misled, and translated German into English miles. Multiplying by 4·6 statute miles, the English equivalent of the German mile, we get less preposterous-looking figures.

Bathymetric Map of Grasmere.—The late Mr. T. A. Green, of Grasmere, made an extremely detailed survey of the lake of that name, and shortly before his death he printed a small number of copies of the resulting map on the scale of 25 inches to a mile, one of which has now been presented to this Society by his niece, Miss L. Sumner. No less than seventy-one lines of soundings have been run across the lake in different directions, and the soundings themselves are given in feet at intervals of about 20 yards. Along each line of soundings a vertical section is drawn showing the depths to the same scale as the distances. In addition to the figures, depths are shown by tints of blue and contour-lines at 10-feet intervals. The lake is the largest of those (except Thirlmere) which were omitted from the survey by Dr. H. R. Mill and Mr. E. Heawood in 1893–94, and on reference to the description of that survey,* it will be recognized that Grasmere belongs, on the whole, to the broad and shallow type, resembling in this respect Derwentwater and Bassenthwaite Water. The lake is divided from north to south by a ridge bearing an island the area of which is a larger fraction of the area of the lake containing it than in any other case in the Lake District. To the west of this ridge the depression is deepest at the northern end, where, however, the maximum depth is only 41 feet, opposite the centre of the island. To the east the depression is considerably larger, and lies towards the south, the deepest sounding obtained being 75 feet. It is interesting to notice that this is within 3 feet of the maximum depth obtained in Derwentwater and Bassenthwaite, and as the level of the two latter was at a minimum when the soundings were made, it may safely be said that the three lakes are of the same maximum depth. The following table has been reproduced from Dr. Mill's paper (*Geographical Journal*, vol. vi. p. 162), with the statistics of Grasmere added:—

Name.	Length miles.	Breadth, yards.		Mean breadth per cent. of length	Elevation of surface above sea, feet.	Depth.			Area, sq. miles.	Volume, million cubic ft.	Drainage area of land.	
						Feet.		Mean per cent. of max.				
		Max.	Mean.			Max.	Mean.				Total in sq. miles.	Ratio to area of lake.
Windermere ...	10·50	1610	930	5	130	219	78½	36	5·69	12,250	88·65	15·5
Ullswater	7·35	1100	927	6½	476	205	83	40	3·44	7870	55·95	16·3
Wastwater	3·00	880	650	12	200	258	134½	52	1·12	4128	18·64	16·7
Coniston Water ...	5·41	870	600	6½	143	184	79	43	1·89	4000	23·34	12·4
Crummock Water ...	2·50	1000	700	16	321	144	87½	61	0·97	2343	16·84	17·3
Ennerdale Water ...	2·40	1000	800	19	368	148	62	42	1·12	1978	16·95	15·1
Bassenthwaite Water	3·83	1300	950	14	223	70	18	26	2·06	1023	91·51†	44·2
Derwentwater ...	2·87	2130	1270	25	244	72	18	25	2·06	1010	31·83	15·4
Haweswater	2·33	600	405	10	694	103	39½	38	0·54	539	11·20	20·7
Buttermere	1·26	670	620	28	329	94	54½	58	0·36	537	6·50	18·0
Grasmere	0·96	766	488	29	204	75	32	43	0·25	184	11·40	45·6

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* *Geographical Journal*, vol. vi. (1895), pp. 46, 135.

† Excluding Derwentwater and Thirlmere drainage areas; including these = 131·2 square miles.

Geology of the Teign Valley.—In a paper read at Sidmouth by Mr. Harford J. Lowe, entitled "The Teign Valley and its Geological Problems," the author divides the valley into four natural parts—the upper, upper-middle, lower-middle, and lower. The first is a gathering-ground of the head-streams, the second a gorge-course, the third the valley track proper, and the fourth the estuarine portion. The upper portion presents all the appearance of a lake-bed, but affords no actual evidence that it is one, and Mr. Lowe suggests that the unusual weathering of the granite here, into the form of a broad depression, is due to traversing dykes of elvan and veins of schorl, the intrusion of which appears to be accompanied by a disintegrated condition of the granite. Mr. Lowe provides an estimate for the carrying out of the gorge track at nearly four million years. In contrast to the upper course, the lower presents the undoubted phenomenon of a lake-basin, for the existence of which it is no less difficult to account. This is the Bovey basin, filled up for the most part with the contents of the upper depression, and estimated at 400 feet in depth. The only possible explanation of its existence seems to lie in the supposition of a small downward counter folding, occurring in the same period as the upward bending of the new Eocene land of the east of Dartmoor. It is of interest to compare the paper with that of Mr. A. J. Jukes-Brown, referred to in the May number of the *Journal* (p. 679).

Vegetation Lines in the Alps.—An instructive study of the vegetation lines in the Tyrolese Alps has lately been carried out by H. Reishauer of Leipzig, who presents the results of his work in the sixth volume of the *Wissenschaftliche Veröffentlichungen* of the Leipzig Geographical Society (1904). In the introduction to the monograph, the author discusses the general principles concerned in the study of vegetation lines, and explains the scope and methods of his own investigations, which were intended to fill a gap left by former students of Tyrolese plant geography, who had paid little attention to the southern part of the region. He therefore chose the Adamello group as a field for research in the south, and in order to make possible a comparison of the conditions with those prevailing in the centre of the Tyrol, carried out a similar examination of the Stubaier Alps, lying in almost the same meridian as the Adamello group, but about a degree further north. The detailed results for each of the groups are presented first, and in the final section of the paper a careful comparison is made between the two. We can only speak here of some of the facts brought out by this comparison, which is the most instructive part of the study. In order to avoid repetition, we may designate the two groups by the letters A and B, A referring to the Stubaier Alps, B to the Adamello group. Taking first the lines of permanent settlement and growth of corn, the author finds that both are far higher in A than B, the differences amounting to 1624 and 1561 feet respectively. This is not to be accounted for by climatic influences, for, although B falls within the Mediterranean floral region, this only accounts for the presence of new kinds of plants in this district. It is rather due to the structure of the mountains (A being composed of slates, B of more sterile tonalite), and to the difference in the inhabitants, the German settler being content with conditions which do not satisfy the Italian. This is emphasized by the fact that if we examine the limit of growth of a tree, such as the cherry, which is less directly influenced by the presence of man, the above great difference in altitude virtually disappears. Similarities between the two regions are naturally to be seen in respect of the influence of various natural factors, such as the general elevation of the country, the aspect of the slopes, nature of the soil, and so on, while in certain directions man's influence is also similar. Coming next to the lines of temporary habitation and pasturage, Herr Reishauer shows that these again are higher in A than B, but the difference is not so marked. Here again its cause is less climatic than orographical, the lack of humus and soil-moisture, the steepness and slipperiness of the tonalite slopes, the absence of much-branching valleys, being all adverse to a large extent of high-level pastures in the Adamello group. The temperament and pastoral systems of the two races here, too, account for much. Lastly, the author examines the differences and similarities in the case of the lines of forest and tree-growth. While these occur on the whole at closely similar elevations in the two districts, the lines are separated by a wider interval in B than in A. The orographical and geological factors, which in B are adverse to the ascent of continuous forest to any considerable elevation, do not act so powerfully in the case of single trees. That the tree-limit is lower in A than B is in part a result of the destruction wrought by man in the case of the former. Many conditions, however (soil, relief, aspect, etc.), operate in a precisely similar way in the two districts. Thus the regions of greatest general elevation are on the whole those where the tree-lines mount the highest. The influence of aspect is everywhere visible, but though trees mount highest on southerly slopes, those facing north are often more favourable to luxuriance of growth.

Distribution of the Hazel, and Changes of Climate in Sweden.—Dr. Gunnar Andersson has lately undertaken an investigation of the former distribution of the hazel in Sweden, with a view to throwing light on the change of climate which the country appears to have undergone within recent geological times. A careful examination of the peat-moors of the central parts of the kingdom, from 59° to 64° N., has brought to light no fewer than 224 localities in which the fruit or other parts of the tree are to be found in a fossil state, and 219 of these lie outside the limits of its present distribution. Dr. Andersson, who has recorded the results of his observations in the *Afhandlingar* of the Swedish Geological Survey (Ser. Ca. No. 3), shows, by means of maps, both the former distribution as shown by these discoveries of fossils, the existing limit of the growth of the tree as a general ingredient of the vegetation, and the area over which it is now found in isolated localities, evidently remnants of its former more extended habitat, specially favoured in respect of aspect or other local conditions. The remains of other trees associated with those of the hazel show that woods of deciduous trees—birch, alder, aspen, mountain ash, and, further south, lime, elm, maple, and even oak—occupied a much larger area, and that at the time of the greatest extension of the hazel the spruce had not yet established itself in this region. From the distribution in relation to the former shore-line of the Baltic during the *Litorina* period, it is held that conditions were already less favourable to the hazel before the subsequent retreat of the sea took place. Dr. Andersson finds that the August-September isotherm of 9°·5 C. (49°·1 Fahr.) coincides with the former limit of the hazel, and that of 12° C. (53°·6 Fahr.) with its present limit. He therefore concludes that the difference between the two values, viz. 2°·5 C., or 5°·5 Fahr., represents approximately the extent to which the mean temperature of these two months has fallen since the time of the greatest extension of the hazel.

Russian Hydrographic Survey of the Baltic Sea.—In a publication of the Russian Hydrographic Office ('Short Historical Sketch of the Hydrography of the Russian Seas,' part iii.) a detailed account is given of Russian work in the Baltic. The first charts of the Baltic, about the middle of the seventeenth century, were of Swedish origin, and the directory appended to the map of Johan Manson (1644) was, until 1721, used by Russian mariners. In the eighteenth century Russian officers began to execute partial surveys, and by the year 1827 they had made general disconnected investigations of the Baltic and the Gulf of Finland. Meanwhile the invention and improvement of surveying instruments had rendered it possible to institute a hydrographical survey on a more thorough system, and accordingly in 1838 it was decided to commence a new survey of the Baltic. Lieut.-General Schubert, director of the Hydrographical Department, was appointed superintendent of the survey, which was to include an astronomical and trigonometrical survey, an examination of the coasts, and soundings. The triangulation was entrusted to Baron W. V. Wrangel, and the coast survey and soundings to Captain M. F. Reineke. The charts were to be drawn on the scale of 1 : 42,000, or nearly 1¾ inch to the nautical mile, and 1 : 16,800, or about 4⅓ inches to the nautical mile for the harbours, bays, and narrow passages. By 1842 a network of triangles had been extended along all the shores and islands of the Baltic and Gulf of Finland, with the exception of the Gulf of Bothnia, and in 1839 the distances of all the triangulation points from the observatory of Reval had been determined. Since then the work has been steadily continued, and the work accomplished in each year up to 1900 inclusive is described in the publication referred to above. Another publication of the same department contains a list, with descriptions, of the marks set up on the coasts of the Ussuri province and Sakhalin to indicate shoals, reefs, and other dangers to navigation.

AFRICA.

The Lake Moeris Reservoir Project revived.—It will be remembered that some sixteen years ago the proposal to restore the ancient Lake Moeris as a storage reservoir for Nile water attracted considerable attention, Mr. Cope Whitehouse being the originator and most enthusiastic advocate of the project. Sir William Wilcocks has lately come forward as a supporter of a similar project, which, he holds, though presenting insurmountable difficulties in 1888, can be made quite feasible if worked in conjunction with the now completed Assuan reservoir. We have received from the author the printed version of a lecture delivered by Sir William at a meeting of the Khedivial Geographical Society in January last, in which the proposed working of the scheme and its relation to the general irrigation system of Egypt are clearly set forth. Now that, with improved drainage, perennial irrigation is everywhere possible given a sufficiency of water, it has become a pressing question to provide the additional 4 milliards of cubic metres required to give such irrigation to the two million acres hitherto without it, thereby adding some £60,000,000 to the wealth of the country. The Assuan reservoir has provided one milliard, but this has already been allotted, and the Government is reluctantly compelled to refuse all further applications for water. By raising the Assuan dam 6 metres in accordance with Sir William's original plan, a second milliard could be obtained, while the remaining amount could, we are told, be easily stored in the proposed modern Lake Moeris. After sketching the history of the old Lake Moeris, which occupied the Fayum, Sir William shows how the Wadi Rayan, separated from the latter (on its south) by a limestone ridge, could be converted into a reservoir, which would not only afford all the supply needed, but would give effective protection from the dangers attending an excessive flood, by which the whole country is so often kept in a state of high tension. The original objection to the project lay in the fact that Lake Moeris, being only slightly above low Nile level, could only give a plentiful supply in the quite early summer, the discharge rapidly falling with the rise of the Nile. But now that, in the Assuan reservoir, a copious supply is at hand capable of being used just when required, the utilization of the Rayan becomes more feasible. It can be drawn upon to the fullest extent in the early summer, thus allowing the Assuan supply to be reserved intact for the later period. According to the plan adopted, the proposed reservoir would give a supply of two or three milliards of cubic metres respectively, the maximum level in the former case being 27, in the latter 29 metres above sea-level. At the higher level the area covered would be 700 square kilometres, or 270 square miles. The larger project provides a feeder canal 18¾ miles long, starting from the Nile north of Sharauna, and capable of filling the lake to a height of 31 metres above sea-level in case of necessity involved by very high floods. There would be an outlet canal of 12½ miles, which could be used, if thought well, for the filling of the lake, a process which is estimated to take 3½ or four years according to the system adopted, the cost of the two schemes being respectively £2,600,000 and £2,000,000.

The Egyptian Sudan in 1903.—In his latest report on the administration of the Sudan, Lord Cromer states that the future of the Sudan appears to depend mainly on (1) good administration; (2) an increase in the population; (3) improvement of communications; (4) water-supply and cotton cultivation; (5) cheap fuel. Under the first heading he expresses the opinion that the work of civilizing the Sudan is being carried on with zeal, energy, and intelligence, and quotes Sir R. von Slatin to the effect that the situation has improved in every respect. As regards population, inquiries made by Sir Reginald Wingate have led to the surprising result, which is said, however, to be supported by weighty evidence, that out of an estimated population, before the Dervish revolt, of some 8½ millions, more than 6½ millions were carried off by disease or warfare, leaving at present a population of only some 1,800,000. As regards irrigation possibilities, whilst urging the need of full inquiry by experts prior to action on a large scale, Lord Cromer says that experiments may be tried, as at present in the Berber district, at irrigating land for cotton cultivation without injury to Egypt. One of the most important needs of the country is the construction of the Suakim-Berber railway, the serious work on which will, it is hoped, be begun in October next, while Lord Cromer anticipates that it will be in working order early in 1906. It is hoped that this railway will enable the Arabian market to be supplied from the Sudan. A narrow seam of coal (or lignite) has been discovered in Dongola, but an expert examination has not yet been possible. Meanwhile Mr. Barron, of the Geological Survey, has been examining the Abyssinian frontier in search of coal-bearing strata. The sudd-cutting operations, which in previous years had failed to open the true bed of the river, were continued in 1903 by Lieut. Drury and Mr. Poole, and it is hoped that free navigation to the waters of the upper Nile will shortly be opened. It must not be thought, however, that this will favourably affect the water-supply to an appreciable extent. Satisfactory results have also been obtained in the Bahr el-Ghazal system. Good progress has been made with the survey work, under the direction of Colonel Talbot, R.E., maps having been prepared of the Blue Nile basin, etc., and frontier delimitations effected, that on the side of Abyssinia having been carried out by Major Gwynne. The work of pacification and development has made progress in the various provinces, including the Bahr-el-Ghazal, where several Niam-Niam chiefs have made overtures to come under Government protection.

Moisture condensed from Clouds on Table Mountain.—Observations on the relative luxuriance of the vegetation on the upper parts of Table Mountain as compared with that of the lower region, where the summer drought can only be withstood by plants showing a special adaptation, led Dr. Marloth to study the question of the amount of moisture deposited by the south-east clouds by which the summit is so often veiled in the dry season, this being evidently the source of supply to the higher vegetation. In order to obtain some idea of the amount so obtained, he established two gauges on the mountain, one an ordinary rain-gauge, the other a similar gauge above which a bunch of reeds was fixed. In spite of difficulties which rendered the observations incomplete, he obtained certain results (published in the *Transactions* of the South African Philosophical Society, part iv., 1903), which gave the surprisingly large figure of 79·84 inches as the amount collected by the gauge with reeds (in spite of the fact that it had overflowed on three occasions), while during the same period—December 21, 1902, to February 15, 1903—only 4·97 inches had been collected in the open gauge. His conclusion is that during the period of observation the gauge with reeds had condensed a quantity equal to 74·87 inches of rain, and that for the whole summer the amount would probably reach 150 inches, exclusive of rain. He holds, therefore, that during cloudy weather the surface of the mountain becomes an immense sponge, affording vegetation the conditions elsewhere supplied in bogs, and that this condensation of moisture must (as has also been thought by other observers) have a considerable influence on the yield of springs in the lower parts of the mountain. In the next number of the *Transactions*, Mr. C. M. Stewart criticizes Dr. Marloth's results, saying that his figures are greatly too high by reason of the large condensing surface offered by the reeds attached to the gauge. By calculating the area of this surface, he finds that the true depth of rainfall represented by the whole amount collected (including the 4·97 of actual rain) is only 11·87 inches, and that the amount collected from the south-east cloud was only 6·90 inches, or 0·12 inch per diem. While, however, he is probably correct in holding that Dr. Marloth's gauge offered specially favourable conditions for condensation, he is surely at fault in his method of comparing the amount of condensed moisture with rainfall, for the important point is, not how much moisture is obtained per unit of condensing surface, but per unit of ground area. No doubt, in the case of actual growing plants, the surfaces are not so freely exposed to the air-current as in Dr. Marloth's gauge, and in many cases the amount condensed would be re-evaporated without ever reaching the ground.* But against this we must set the fact that the growing plants would frequently be of a much greater height than Dr. Marloth's reeds, so that the condensing surfaces would be thereby increased. This shows, however, the great difficulty, if not impossibility, of obtaining trustworthy figures representing the average amount actually condensed, though it is of interest to know that in certain cases at least it may reach the amount obtained by Dr. Marloth.

AMERICA.

Recent Change of Level at New York.—Trustworthy measures of the rate of change in the relative level of land and sea are still rare enough to make every addition to their number welcome. Mr. G. W. Tull has recently published (*Am. Jour. Sci.*, xvii., 1904, p. 333) the result of his examination of the records obtained from self-registering tide-gauges at and near New York, from 1850 to 1903. He finds that the sea-level is subject to considerable temporary change, mainly determined by the direction and force of the winds. Westerly and north-westerly winds depress the sea-level by as much as 3 feet; easterly and north-easterly winds raise it, but their effect is less than that of the westerly winds, on account of their smaller force and lesser duration; variations of barometric pressure seem to have little effect except in so far as they influence the wind. As the effect of pressure and wind, on the sea-level, at any place, is the integral of their effects taken over a wide area, while the observations are only taken at one point, a close correspondence is not to be expected; yet there is a remarkable agreement between the monthly variation in sea-level and the movement of the north-westerly winds. The monthly changes of level show a minimum, sharply defined, in January, and a maximum, not sharply defined, in August; while the westerly winds have a maximum, sharply defined, in January, and a minimum, not sharply defined, in August. The seasonal difference of level due to this cause averages 0·55 foot. There is also a variation, from year to year, in the annual mean sea-level. This variation is irregularly periodic with a period of three to eight years, and a range of about 3 inches; it can be traced all along the Atlantic coast, and is in close agreement with the yearly variations in the height of the barometer and the force and direction of the wind. Apart from these periodic variations, no alteration in the mean sea-level can be detected between the years 1853 and 1875, but from 1875 to 1902 there was a gradual rise of sea-level at the rate of 1·45 foot per century. This rise cannot be attributed to any meteorological cause, and must be due either to a rise in sea-level or a subsidence of the land; in view of the fact that so many European and Asiatic tide-gauges show no progressive change of level, the author concludes that the latter is the true explanation, and not the former.

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* This may also be the case with light rain falling on the surface of vegetation, but it is none the less included in any estimate of the total rainfall.

The Geodetic Operations in Ecuador.—The report lately presented to the Paris Academy of Sciences by M. Poincaré summarizes the work carried out by the French observers in Ecuador during 1903. The programme included the completion of the observations in the northern area, geodetic work on the Riobamba—Cuenca section, astronomic observations at Cuenca, magnetic observations, and, lastly, the inauguration of the levelling. Owing to various hindrances, this could not be carried out in its entirety. The unfavourable meteorological conditions alluded to in the previous report (*Journal*, vol. xxii. p. 215) continued to be experienced in the northern area, and at three stations it was necessary to remain no fewer than eighty days on this account. The destruction of the signals by the natives also continued to some extent, in spite of the earnest efforts of the Ecuadorian authorities to put a stop to it. However, the work here was finished on February 15 last, and by a preliminary calculation, M. Maurain was able to work out the connection between the bases of Riobamba and Tulcan, the result being to give for the length of the northern base 6604·83 metres, as compared with 6604·77 metres obtained by actual measurement. It is, perhaps, not to be expected that a closer agreement will be made out when the final calculations are made, but it is clear already that a high degree of accuracy has been attained. In the southern area latitude observations have been commenced at Cuenca, and M. Maurain was about to determine the difference of longitude between that station and Quito. The network of triangulation originally laid down in this region will be shifted to the west; for, owing to the disturbances in Columbia, it was found necessary to obtain the required 6° of arc by extending the work south to Payta, which lies much to the west of the prolongation of the original line. This will facilitate operations by bringing them within the drier zone of the western chain of mountains. Levelling work has been done on the north-to-south section between Riobamba and Alausi, and the results are said to be excellent. There remains the east-to-west section from Alausi to Guayaquil, where the chief difficulty will occur at the passage of the Guayas river, a little before Guayaquil. Pendulum work has not made much progress; but one interesting result has been obtained, the results already worked out proving the correctness of Bouguer's formula for this region, whereas it has not been applicable in the Alps and Himalayas. Thus M. de Lapparent's views, based on the tectonic differences between the Andes and Himalayas, are fully borne out. It is hoped that the remaining operations will be completed by the end of 1904.

Roads across the Andes in Peru.—A pamphlet compiled by order of the Minister of Foreign Affairs describes eight routes over the Andes. The most northerly runs from Paita to the Pongo de Manseriche on the Marañon. From

Paita a railway runs 56 miles to Piura; thence to Bagua Chica there is a bridle-road 317 miles long; and the section of the road from Bagua Chica to the Pongo, 211 miles, was under construction in the year 1903. A party of North American engineers has made surveys for a railway from Paita, through Olmos, Huarmanca, and Bellavista to the Pongo, and maintains that this is the best route in South America for a line across the Andes. At Olmos this route joins the road, 120 miles long, to the Marañon at Bellavista, which in the other direction extends 60 miles, to Ferreñafe, a town connected with the Port Eten by a railway 48 miles long. From Pacasmayo there is a railway to Tolón, 36 miles, and thence a bridle-road, 500 miles long, through Cajamarca, across the Marañon (on rafts), and through Chachapoyas and Moyobamba to Yurimaguas, on the Huallaga. It is intended to re-construct the most difficult section, just beyond Moyobamba. The railway from Callao to Oroya, 137 miles, is famous as attaining the greatest altitude of any railway in the world, and thence to Cerro de Pasco a railway built by an American syndicate was to be finished last year. Hence Huanuco can be reached along a bridle-path in two days, and the Rio Mairo in six days more when a road now under construction is finished. This river can be navigated by boats of small draught which descend it, the Palcazu, the Pachitea, and the Ucayali, and reach the Amazons in five days. Another affluent of the Pachitea, the Pichis, can be reached by a road 205 miles long, from Oroya to Puerto Bermudes. From this road another branches off at Tarma and passes through Chanchamayo to the lowest falls of the Perené. From the port of Pisco a railway, 46 miles long, runs to Ica, whence it is three days' journey to Ayacucho, and six more to Puerto Bolognesi, on the Apurimac, which unites with the Mantaro to form the Ene, and this again with the Perené to form the Tambo. The last route mentioned does not lead to a tributary of the Marañon, but to the Inambari, a tributary of the Madre de Dios. Starting from Mollendo, the traveller can journey 298 miles by train to Arequipa and Juliaca, and, taking the branch to Sicuani, leave the train at Santa Rosa and ride through Macusani, Ayapata, and Llinquipata to the river San Gaban, which flows into the Inambari and is navigable by small canoes. The Peruvian government has authorized the construction of a line from Tarma to Chanchamayo, and a North American company has obtained the right of examining two routes on the north of Peru, but the necessary capital has not hitherto been forthcoming.

Dr. Hans Steffen's Journey on the Coast of Southern Chile.—A pamphlet issued in Valparaiso, under the title 'Bericht über eine Reise in den Chilenische Fjordgebiet, nördlich von 48° S. Br.', describes the journey made by Dr. Steffen in the summer of 1898–99, with Count von Schulenburg and Messrs. Michell, Hambleton, and Krantmacher. From Puerto Montt at the head of the Gulf of Ancud the route followed the east coast of the island of Chiloe, and then pursued the "inner lead" within the islands of the archipelago to the south. The great Taitao peninsula was completely encircled, and the inlets east of it, Estero Elefantes and its branch Estero San Francisco, explored. Continuing south, the Estero Kelly and Jesuitas were also entered, and finally a complete exploration was made of the various branches of the Estero Baker, including a journey up the Baker river to Lake Cochrane and journeys a short distance up the Bravo and Pascua rivers, which enter branches of the same inlet. The pamphlet consists mainly of physical description and an account of the circumstances of the journey, and is provided with a general map and a detailed map of the country visited south of the Taitao peninsula.

POLAR REGIONS.

Ice and Barometric Pressure in the East Greenland Sea.—It is well known that the position of the limit of pack-ice in the northern seas differs enormously in different years, some being especially favourable from the point of view of navigation, others just the reverse. To trace the connection which exists between these variations and those of barometric pressure has been the object of an investigation by Herr W. Brennecke, whose conclusions are summarized in the *Annalen der Hydrographie* (1904, Heft ii.). The writer begins by examining the data regarding the state of the ice from 1877 to 1895, principally on the basis of the work of Captain Ryder published in 1896. Defining as years of unusually much ice those in which it has reached the southern coast of Iceland in the spring or summer, or in which Jan Mayen has been still closely beset in June and July; and as years of unusually little ice those in which hardly any has been seen in the vicinity of Iceland; he finds that 1881, 1882, 1888, and 1891 belong to the former category, and 1884 and 1889 to the latter. He next points out that, apart from local changes due entirely to wind, changes in the position of the ice-line are due to the greater or less extent and intensity of the surface polar current, and this above all to the prevailing winds, so that it is to the causes of variation in the direction of the latter that we must look for an explanation of the variations in the ice-conditions. He therefore examined in detail the distribution of barometric pressure over the northern Atlantic, and found that this showed great variations from one year to another, abnormal conditions often prevailing for months together. The barometric conditions from March to May were also found to exercise a preponderating influence on those of the ice. Taking as a basis the variation in pressure on 70° N. between 20° E. and 20° W. of Greenwich, he found that in years of much ice the difference was much greater than the normal, while in years of little ice it sometimes fell to zero. Thus in 1884 and 1889 the barometric minimum usually found along the west coast of Scandinavia disappeared entirely, while in 1881, 1882, and 1891 the depression was greatly accentuated. The general conclusion is reached that the strengthening of the northerly wind currents, which result in an advance of the ice southward, is due to a lowering of pressure over northern Scandinavia and an increase of pressure over Greenland, the conditions south of 65° N. being without influence. The extent of the gradient between March and May is of primary importance, though its value during the winter months has an influence, though only a secondary one. The writer also examines the temperature conditions, both of the sea and atmosphere, in their relation to those of the ice, and finds, as was to be expected, that the temperature of the surface water of the East Greenland sea and of the air over Iceland and northern Europe is abnormally low in years of much ice, and the reverse when the ice is at a minimum.

The British Antarctic Expedition.—The *Discovery* sailed from Lyttelton on her homeward voyage on June 8, but is not expected home before September. During the stay of the expedition in New Zealand, the following telegram was sent to Captain Scott by the King's orders: "I have read with interest your report, which Sir Clements Markham sent me. I congratulate you and your gallant crew on your splendid achievements, and wish the *Discovery* a safe journey home. I hope to see you on your return to England." The Royal Scottish Geographical Society has expressed its sense of the good work done by the expedition by awarding to Captain Scott the Livingstone Gold Medal for the year.

The Scottish Antarctic Expedition.—The *Dundee Advertiser* for May 31 contained a letter from Captain Robertson, describing the second voyage southward of the *Scotia*, begun at Port Stanley on February 9 of the present year. The voyage has led to important results, having brought the explorers, if their conclusions are correct, to the edge of the Antarctic continent, in a latitude far to the north of that in which it has hitherto been hypothetically drawn in this quarter. After a week spent at the South Orkneys, where Messrs. Mossman and William Smith were left to continue the scientific observations for another year, the *Scotia* sailed south-east (February 22), reaching the pack in 66° S. A southward course was continued till March 3, when, in lat. 72° 25′ S., long. 18° W., the ice-foot of the supposed continent was reached. Had Sir James Ross advanced 50 miles further south in 1843, he must have made the discovery. The glacier was followed south until March 7, when, in 74° S., 24° W., a severe blizzard was encountered, and the ship was beset and lifted 4 feet by ice-pressure. The continent spread out as a vast wilderness of barren ice, but the sea teemed with life—seals, emperor penguins, antarctic and snowy petrels, etc. It was feared that the ship might remain fast for the winter, but on March 14 the ice began to crack, and the ship at last became free, and by March 22 got clear of the pack. Crossing the part of the ocean known as Ross's deep, a sounding of 2650 fathoms was obtained where Ross found no bottom with 4000 fathoms. This figure, as to the accuracy of which some doubts have hitherto been felt, must therefore, it seems, have been an error. Continuing to steer north, the *Scotia* reached Gough island, sounding and trawling all the way. At Gough island a party landed with great difficulty, owing to the swell rolling in on a rocky shore, and spent a day making collections. The island is fertile, and has an inviting appearance, though there are no inhabitants. After a fine passage, during which soundings of 1807, 2600, and 2900 fathoms were obtained in turn, the cape was reached on May 5. Mr. Bruce's work is particularly valuable from the point of view of oceanography, and his soundings give quite a new idea as to the contours of this part of the ocean floor. He is expected to reach this country during July. We are pleased to state that a gold medal has been awarded to the explorer by the Scottish Geographical Society.

GENERAL.

The Anglo-French Agreement.—The agreement between France and Great Britain signed on April 8 last has not brought about any extensive changes of frontier, being rather concerned with the definition of political rights in regions in which one or other power exercises an influence, as in Egypt and Morocco. The principal cessions of territory are in Africa, where France obtains (1) a small area on the Gambia, including Yarbutenda, near the head of navigation, the frontier being so arranged as to give France access, in any case, to the navigable waters; (2) the small group of the Los islands lying off Konakri, the capital of French Guinea; (3) two strips of territory to the north of British Nigeria, whereby a practical route from Say to Lake Chad will be assured within French territory. The arbitrary and unnatural irregularities in the course of the frontier are thus smoothed off, the eastern and western sections forming more or less natural continuations of the line to the south of Zinder adopted in 1898. The last section of the line in the direction of Lake Chad follows the course of the Waube-Komadugu. As regards Siam, while the main provisions of the treaty of 1896 (*Journal*, vol. xii. p. 297) are re-affirmed, a supplementary declaration is added whereby the portions of the kingdom lying to the east and west of the basin of the Menam are definitely stated to be under French and British influence respectively. It will be remembered that, by the treaty of 1896, the territory guaranteed to Siam included, in addition to the basin of the Menam, certain areas on the gulf of Siam on the east and west of that basin, as well as a small area to the north of the Menam basin adjoining the kingdom of Luang Prabang. The first two areas fall now, however, to the French and English spheres of influence respectively, while that to the north, not specified in the new declaration, must be held to remain as assigned in 1896; although the rectification of the frontier of Luang Prabang, carried out by the Franco-Siamese treaty of February last, would seem somewhat to encroach on the central Siamese zone as defined in that year. In Newfoundland France at last abandons her special rights on the so-called French shore in the north and west of the island established by the Treaty of Utrecht. Lastly, in Madagascar Great Britain withdraws her protest against the tariff introduced by France, and in the New Hebrides a commission is to be appointed to settle the differences between French and British settlers.

The International Geographical Congress in the United States.—We have received a draft programme in detail of the proposed proceedings of the Eighth International Geographical Congress. The formal opening will take place in the Colombian University Hall, Washington, on the morning of September 8, an informal reception by Dr. McGee, president of the National Geographic Society, being held the evening before. During the three days' proceedings at Washington general meetings will be held in the morning; sectional meetings, receptions, and social gatherings in the afternoon. On Monday, September 12, the Congress will be entertained by the Philadelphia Geographical Society, and on Tuesday and Wednesday by the American Geographical Society in New York. On Thursday, September 15, there will be a trip up the Hudson, and on September 16 a field meeting at Niagara Falls. Chicago will be visited on September 17, and on Monday, Tuesday, and Wednesday, September 19 to 21, the Congress will join in the meetings of the Congress of Arts and Science at St. Louis. A trip to the Far West is planned after adjournment, and on return to Washington the Congress will be received by President Roosevelt. It is hoped that a definite programme, with announcement of the papers to be read at the meetings, will shortly be issued.

British Geographical Exhibits at the St. Louis Exhibition.—The Royal Commission entrusted with the organization of the British exhibits at the St. Louis Exhibition has issued a catalogue of objects shown in Group 18 of the department of liberal arts, which embraces the subjects of Geography and Exploration. The first of the bodies exhibiting under this section is the Ordnance Survey Department, which has sent specimens of maps issued by the Survey on various scales from the 10-mile-to-the-inch map of Great Britain to the 5-feet-to-the-mile plan of London. The Topographical section of the Intelligence Division of the War Office exhibits specimens of the 1:1,000,000 general map of Africa now in course of issue, and of the larger-scale maps of special regions (also chiefly African) prepared in connection with recent events of importance. Our own Society is well represented by a selection from its publications and other objects of interest, including (1) a complete set of the *Journal* to the end of 1903, and of the extra series, together with the 'Antarctic Manual,' 'Hints to Travellers,' etc.; (2) a mounted set of the more important maps and illustrations contained in the *Journal*, etc.; (3) portraits of Presidents of the Society; (4) miscellaneous photographs, including those of Livingstone's tree and memorial, Stuart's tree, the *Discovery*, etc., etc.; (5) photographs of explorers' original manuscript maps; (6) photographs of the Society's gold medallists and case containing medals; (7) a selection of instruments recommended for use by explorers and geographical surveyors. Other organizations represented are the Cretan, Egypt, and Palestine Exploration Funds, the Hydrographical Department of the Admiralty (which exhibits specimens of original and published charts, and special types of instruments used in hydrographic work), and the Royal Observatory; while specimens of their publications are sent by such firms as Stanford, Bartholomew, Keith Johnston, and others.

OBITUARY.

Henry Morton Stanley.

By E. G. Ravenstein.

The death of Sir Henry Morton Stanley, in the early morning of May 9, removes one more of the few survivors of that valiant band of pioneer explorers whose labours during the second half of the nineteenth century revealed to us the geographical features of tropical Central Africa. Sir Henry's health had been indifferent for some time past, but the immediate cause of his death was a chill, which developed into pneumonia and pleurisy. Lovingly nursed by a devoted wife during the whole of his illness, he remained conscious to the last.

Stanley, or, to call him by his original name, James Rowlands, was born in Denbigh, of humble parents, on June 10, 1840. He was educated at an elementary school at St. Asaph, and might have remained there to the end of his days as assistant teacher had not a laudable ambition and the consciousness of his capacities impelled him to seek a more promising field of activity. When about seventeen years of age he walked to Liverpool, and managed to obtain a passage in a vessel proceeding to New Orleans. There he was fortunate enough to find in Mr. Henry Morton Stanley, not only an employer but also a friend, who treated his young clerk as an adopted son, and would no doubt have provided for him had he not died prematurely. Young Rowlands at that time adopted the name of his benefactor, and made it famous. He was engaged in the American Civil War, enlisted in the American navy, and is understood to have served for a time on board the *Ticonderoga*.

On the conclusion of the war, Stanley entered upon that journalistic career which gave scope for the display of his abilities, and enabled him to follow the path which led up to fame and fortune. In 1867 he left New York as a special correspondent of the *New York Herald*, charged with the duty of recording the operations of the English punitive expedition in Abyssinia; and so well did he perform this duty, that the news of the fall of Magdala was received earlier in New York than it was in London.

The Finding of Livingstone.

When he returned from Abyssinia, Stanley was sent by the proprietor of his journal to Spain, but on October 16, 1869, Mr. James Gordon Bennett summoned him by telegraph to Paris. Stanley started at once, arrived in Paris in the middle of the night, found Mr. Bennett in bed, and was abruptly commissioned to "Find Livingstone," who had left the coast for his last journey in March, 1866, and had not been heard of for a number of years. It seems rather curious, under such circumstances, that Stanley, instead of proceeding direct to Zanzibar, should not only have attended the opening of the Suez canal, in November, but should also have travelled to India, by way of Constantinople, the Caucasus, and Persia. His arrival at Zanzibar was thus delayed until January 6, 1871, and already on February 18 the first detachment of his caravan left Bagamoyo for the interior. The direct road from Unyanyembe to Lake Tanganyika being closed in consequence of hostilities between the Arabs and Mirambo, a powerful native chief, Stanley travelled by a southern route, and safely reached Ujiji on November 10, where he had the good fortune to meet Livingstone, who, only nineteen days before, had returned to that place from the west. The relations between the veteran explorer and his young and ardent "deliverer" were extremely cordial from the first. Jointly they travelled to the northern extremity of the lake, and then proceeded eastward to Unyanyembe, where Livingstone waited until the supplies forwarded by the Royal Geographical Society's Relief Expedition,[*] under Lieut. Llewellyn Dawson, had reached him, when he once more plunged into Central Africa, only to die there. Lieut. V. L. Cameron, in August, 1873, met Livingstone's servants in Unyanyembe, carrying the body of their beloved master to the coast. Long before this, on May 6, 1872, Stanley had reached Bagamoyo on the East Coast; in August he was once more in England. He made his first appearance in public before an enthusiastic meeting of the Geographical Section of the British Association at Brighton, and on October 21, at a dinner given in his honour, he was presented with the Patron's Medal of the Royal Geographical Society "for his relief of Dr. Livingstone, and for bringing his valuable journals and papers to England." The Council decided to award this medal six months before the time, an honour which has never been accorded to any other explorer.

"*Through the Dark Continent.*"

The "finding" of Livingstone had won Stanley popularity; his next expedition was to gain for him a foremost position among African pioneer explorers, not only of the nineteenth century, but of all times. It was on his return from Ashanti, in 1874, whither he had gone as the correspondent of the *New York Herald* to report on General Wolseley's military operations, that he heard of the death of his friend Livingstone. He at once made up his mind to complete the work which death had prevented the great missionary-traveller from accomplishing. The proprietors of the *Daily Telegraph* and the *New York Herald* most readily supplied the funds for the proposed enterprise, and already on November 17, 1874, he was able to start from Bagamoyo with a well-organized caravan. The geographical labours accomplished during this the most memorable journey ever undertaken resulted in a vast increase of our knowledge of the continent. The Victoria Nyanza was circumnavigated, and was given approximately its correct shape upon our maps; another lake, now known as the Albert Edward and distinct from the Albert Nyanza, was discovered to the westward; our knowledge of the basin of the Kagera or Alexandra Nile was much extended; the Tanganyika was circumnavigated, and the Lukuga, its outlet, more closely examined; and lastly, to crown all, the Lualaba was traced from Nyangwe, the furthest point reached by Livingstone and Cameron, to the highest point on the lower Congo reached by Tuckey in 1816. When Tippu Tib, the notorious Arab chief, who had joined his forces to those of Stanley, retraced his steps, the latter, nothing daunted, embarked upon the unknown river, and, despite of physical obstacles and the hostility shown by cannibal tribes, accomplished his object. At length, on August 12, 1877, just one thousand days after he had left the East Coast, Stanley stood at Banana on the open Atlantic. Of the [illegible] men with whom he had started, there remained with him only 114; the others were dead. Stanley himself had turned grey, although not yet forty-eight years of age.

The results of this memorable expedition were not geographical only. Even whilst Stanley was still hidden in the heart of Africa, in the spring of 1876, the Church Missionary Society sent out a pioneer expedition, with a view to the occupation of Uganda, which had been described as a most promising field for missionary labour, and in July, 1877, the Rev. C. T. Wilson had his first interview with King Mtesa. Two years afterwards witnessed the arrival of Roman Catholic missionaries.

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[*] For a report on the Livingstone Relief Expedition, see *Proceedings R.G.S.*, xvi., 1872, pp. 412-442.

Henry M. Stanley

The Congo Free State.

Stanley's account, however, of a vast system of navigable rivers giving access to a considerable part of tropical Africa, and of the resources of the countries through which he had passed, at once roused the attention of the commercial world, and his prediction that the Congo, at an early date, would occupy the political world likewise, was soon to be realized. The King of the Belgians, who had founded an international association for the exploration and civilization of Africa in 1876, was one of the first to grasp the future importance of the Congo basin. When Stanley landed at Marseilles in January, 1878, he was met by agents of King Leopold, and ultimately persuaded to place himself at the head of an expedition to be fitted out by a "Comité d'études du Haut Congo," the objects of which were declared to be philanthropic, scientific, and commercial. Stanley's stay on the Congo extended from August, 1879, to June, 1884. By the time he left, Stanley had cut a road from the lower Congo to Stanley Pool, whence his nickname a "Mbula Matadi," or "rock-breaker," given him by the natives. He had carried up the road four small steamers in sections, and had launched them upon the upper Congo; and he had built forty stations, as high up as Stanley falls. This remarkable success in the face of exceptional difficulties, and the inexperience or unfitness of many of his subordinates, afforded once more proof of Stanley's indomitable energy and fulness of resource. Whilst still out in Africa the "Comité" had developed into an "Association Internationale," and before the Berlin Conference rose from its labours, on January 30, 1885, this "Association" had been reorganized as an independent state under the sovereignty of the King of the Belgians.*

The Emin Relief Expedition.

Stanley's fourth expedition into Africa was undertaken for the relief of Emin Pasha, a man of great scientific attainments whom Gordon had appointed Governor of Equatoria, and who, after the murder of his chief at Khartum in January, 1885, had maintained the Khedivial authority in his province, but, being hard pressed by the Mahdists, had appealed for succour to his friends in England. A government expedition being impracticable at the time, owing to political reasons, Sir William Mackinnon started an "Emin Pasha Relief Fund," which ultimately reached £33,000, including a contribution of £14,000 from the Egyptian Government, and of £3,000 from Sir William himself. Stanley gave up a lucrative lecturing tour in America, and assumed the command of the expedition. For reasons which it is unnecessary to detail here, he elected to take the Congo route to Equatoria. On March 29, 1887, he left the mouth of the river, and on December 12 his advance-guard looked down from Kavalli upon Lake Albert. But it was January 18, 1889, before the whole of his forces were assembled there. Of 646 men with whom he had started there now remained with him only 246! Quite 400 had died of disease, had been killed whilst forcing their way through the forest primeval to the south of the Aruwimi, or were missing. The losses of the rear column had been especially disastrous, and this Stanley ascribed to "the irresolution of the officers and their total disregard of the written instructions;" an accusation strongly resented by the friends of Major Barttelot and Mr. Jameson, the former of whom had been shot in July, 1888, whilst the latter had died at Bangala in August of the same year. As for Emin Pasha, he looked for fresh supplies of ammunition, and not for a rescue. "I will on no account leave my people," he wrote as lately as September,

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* For a history of this Conference and the results which sprung from it, see Keltie's 'The Partition of Africa' (London, 1893).

1887, to Dr. Felkin. And even after his people had flouted his authority and made him a prisoner, he hesitated to follow Stanley to the East Coast. When a start was made at last, on May 8, 1889, only about fifty clerks and soldiers were ready to follow their old chief. On December 4 the expedition reached Bagamoyo, and Emin Pasha, after he had recovered from an accidental fall out of a window, severed all intercourse with his English liberators, and, instead of proceeding to Egypt or Europe, entered the German service, and at once returned to Lake Albert. Being rejected by his people who were encamped there, he turned to the westward, and on October 20, 1892, was killed by his guide when a few days' journey from the upper Congo. As far as Emin Pasha was concerned this expedition, therefore, proved a failure, whilst the geographical results, although of considerable importance, were hardly commensurate with the heavy loss of human life and expense incurred. The most important discovery made was that of the snow-clad Ruwenzori, which Stanley unhesitatingly identified with Ptolemy's Mountains of the Moon. Stanley himself, when he returned to England, met with an enthusiastic reception. The Royal Geographical Society, in May, 1890, at a monster meeting at the Albert Hall, presented him with a special gold medal "for his last journey across Africa and the Relief of Emin Pasha." Bronze medals were presented to the officers—Stairs, Dr. Parke, Nelson, Mountenay, Jephson, and Bonny—who had followed him to the East Coast, and silver stars to his native followers. The American residents dedicated to him a testimonial shield of silver, designed by Mr. H. S. Wellcome, whilst universities, city companies, and scientific societies competed with each other to do him honour. The freedom of the City of London had already been presented to him, in a gold casket, in 1887, before he set out on his last expedition. An undeniable proof of Stanley's popularity at the time was expressed by the crowds which gathered within and around Westminster Abbey when, on June 12, 1890, he was married to Miss Dorothy Tennant.

Soon after his marriage, in October, and accompanied by his wife, Stanley started on a lecturing tour through America and Australia. On his return home he was re-naturalized, and in 1899 the Queen conferred upon him a Grand Cross of the Order of the Bath. From 1895 to 1900 he represented North Lambeth in Parliament; but he spoke only on rare occasions, and as years advanced and the hardships which he had undergone during his African wanderings began to tell upon him, he retired almost completely from public life, and having purchased a small estate, Furze Hill, near Pirbright, in Surrey, he spent much of his time in rural retirement. And in the little churchyard of Pirbright, after an impressive service in Westminster Abbey, his remains have found a resting-place.

Henry Sharbau.

It is with great regret that we record the death of the Society's chief draughtsman, Mr. Henry Sharbau, the extent and excellence of whose cartographical work, carried out in that capacity during a period of nearly a quarter of a century, is a matter of knowledge to all, whether at home or abroad, who are acquainted with the Society's publications during that time. Mr. Sharbau, who had passed the age of eighty, had for some time been in failing health, and the death of his wife not many months before his own came as an additional blow from which he never recovered, though he stuck to his work manfully almost to the last.

Mr. Sharbau was born at Lübeck in North Germany in 1822, but came to this country when a young man, his special aptitudes in the direction of surveying and draughtsmanship finding scope, firstly in work on the Ordnance Survey of the south of Scotland, and afterwards (between 1858 and 1864) in the Admiralty Surveys in the Hebrides and some of the western lochs. In 1861 he assisted in the survey of Loch Lomond under Captain H. C. Otter, R.N., and in 1864 in that of Loch Sunart under Captain E. J. Bedford, R.N., his chief in the Hebrides work having been Commander F. W. L. Thomas, R.N. In 1865 he was appointed temporary assistant in the Hydrographic Office, a post which he held for nine years, or until 1874. In this year he became naturalized as a British subject. Obtaining an appointment under the Japanese Government, he was engaged in survey work in Japan for about two years, and after his return did work as a draughtsman for the Home Office, Admiralty, and in Stanford's establishment until his appointment under the Royal Geographical Society in 1881.

Mr. Sharbau's work was marked by its painstaking and conscientious character; he spared no pains in the working up of the cartographic material brought home by travellers, and its correlation with previous work of the kind. One of the most important results of his labours in this direction was the map of Tibet, compiled by him under the superintendence of General Walker, and first published by the Society in 1894. Those who have only seen his maps as they came from the lithographer's hands have little idea of the excellence of the original drawings, which possessed an artistic finish which was frequently to some extent lost in the final product. Mr. Sharbau belonged to a type of cartographers which is none too common in this country, and his place in the curriculum of the Society's work will not easily be filled.

Obituary of the Year.

The following is a list of the Fellows who have died during the year 1903–1904 (April 30):—

Captain W. S. D. Abbott; Captain L. R. Arthur; Captain G. H. Abadie; Richard James Ashton; George R. Boyle; G. W. Brangwin; W. P. Bransom; J. A. Brown; W. Babington; Hon. G. C. Brodrick; Marmaduke H. Brooking; W. M. Bickerstaff; J. H. Browne; Admiral Henry Boys; Lieut.-Colonel R. Burnaby; Reginald Beech; Lord Colville; J. F. Cobb; Gerald C. Clark; Major-General R. H. Cunliffe; C. E. Campbell; George R. Clark; Lawrence Cussen; Rev. W. J. Craig; Admiral E. J. Church; William Cope Devereux; Sir Edwyn Dawes; John Dugdale; R. J. Donohue; F. Dessen; W. Dawes Freshfield; W. D. Forbes; H. B. Francis; General J. G. R. Forlong; J. S. Forbes; A. J. Gunn; George Gill; J. B. Guthrie; F. St. John Gore; Sir Frank Green; J. J. Gurney; G. E. Y. Gleadowe; Dr. C. H. Gatty; Admiral G. H. Gardner; Colonel H. H. Harvey-Kelly; James Hingston; Benjamin Hocart; T. J. Haughton; C. W. C. Hutton; J. W. Hutchison; Major-General A. H. Hutchinson; S. D. Hopkinson; W. Hounsell; William Hole; Captain Hull; Commander R. P. Jenkins; Dr. J. W. Johnson; J. P. Joaquim; J. Watson-Knight; Louis Levinsohn; General D. Macintyre; P. H. S. Montgomery; E. Masterman; General John Macdonald; Captain A. T. Miller; R. Massie; H. E. Nubar Pasha; Sir Charles Nicholson; George Palmer; Sir James Poole; Archdeacon Pritt; Major C. B. Phipson; General Sir A. Power Palmer; Andrew Pears; T. G. Rooper; A. B. Rathborne; J. K. Rennie; Charles William Roberts; Sir John Robinson; Rev. C. M. Roberts; G. W. Rusden; E. B. Savile; John Stedman; William Sherriff; The Marquis of

Salisbury; Rev. P. F. Swann; Frederick Schlusser; W. Balin Smith; C. J. F. Sevier; Major A. R. Stuart; R. M. W. Swan; C. A. Thurburn; John Terry; Augustus Thorne; H. G. B. Thornton; W. G. Thorpe; Sir J. W. Trutch; H. L. Taylor; John Taylor; Cardinal Vaughan; Hon. H. P. Vereker; Rev. G. T. Warner; A. A. Weston; John Watts; S. J. Weston; W. L. Watson; Edward Wilkinson; Rev. John Waite; J. Poole Wagstaffe; Christopher Ward.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1903–1904.

Anniversary Meeting, May 16, 1904.—Sir Clements Markham, K.C.B., F.R.S., President, in the Chair.

The Secretary read the minutes of the last Anniversary Meeting, which were confirmed and signed by the Chairman.

The Secretary read a list of the newly elected Fellows of the Society.

Elections.—*James Henry Balmer; Thomas Barbour; Rev. Ernest Clapham Bayliss; Captain Edward Berry; Captain R. A. Birley, R.A.; Lionel O. Bowles; Paul August G. Brönnte; Austin Hobart Clark; Frank Gerard Clemow, M.D.; Alexander George Cox; Captain Reginald Cox,* 19*th Hussars; Ralph Adams Cram; William Parker Devine; W. J. Gillespie Dickson; Alexander Ferguson; William Forbes Fisher; Harry English Fulford, C.M.G.; Frank Nicholson Gibbs; Rev. John Gleeson; A. C. Grylls, M.A.; Alfred James Hamilton; Rev. Isaac Hartill; Louis Condit Hay; Charles Davis Jameson; Francis James Kelly; William Orr Leitch; Cyril Longhurst; Captain Mackintosh, R.A.; C. V. Le Fanu, M.B.; Gilbert St. John McDonald; Marsden Manson; E. Medd; James Bernard Mowat; Charles Walker Neligan; Lieut. Edward Osborne Armstrong Newcombe, R.E.; Richard Clements Nicolaus; Gerald Arthur Sheppard, B.A., LL.B.; Lieut. H. L. Norton Smith* (4*th Highland Light Infantry*); *Captain Alec Gavin Stevenson, R.E., D.S.O.; Rowland Storey; R. A. Walker; Archibald Williams; Ernest Colville Wilton; Captain F. C. Heneker* (*Leinster Regiment*); *Captain Harold Arthur Clement Mackin; Allister Mitchell Miller; M. C. Petters.*

Honorary Corresponding Member.

Dr. Otto Nordenskiöld (leader of the Swedish Antarctic Expedition).

The presentation of awards then took place.

The President: Sir Harry Johnston, the Council has decided to award you the Founder's Medal, the highest honour the Society has in its power to bestow, and His Majesty the King has approved of the award. Your services on behalf of geography are cumulative, and they have all been important, first on the western side of Africa, then at Nyassa Land, and then Uganda. You have always done yeoman service to the cause of African discovery. I cannot help alluding to your great administrative talent in the government of those colonies which have had the very good fortune to be under your guidance, for amidst that work you have never failed to advance the cause of geography. It is a very great pleasure to me that it should devolve upon me to give this award, the Founder's Medal, to such a very old friend, and to one whose great ability, energy, and talent has always had my warmest admiration. I now place in your hands the Founder's Medal.

Sir Harry Johnston: I think that very few words are needed from me to convince you that I am fully sensible of the honour, the very great honour, almost the greatest honour in the geographical world, that has now been conferred upon me, and also of the peculiar gratification at receiving this honour from the hands of Sir Clements Markham, who is, as he has been kind enough to remind me, one of my oldest friends. From the very first, when, scarcely more than a boy, I was anxious to go out and explore the world, I received great kindness, encouragement and assistance from Sir Clements Markham. In those days, now remote to me, he was the secretary of the Society of which he is now the President, but in those days, in the early eighties, he was always ready to help me in every way that he could, and assist me to explore Africa with as little cost as possible to my own resources. I do not think I shall ever forget the encouragement I received from him—an encouragement which perhaps did much to turn me in that direction. The pleasure that I am experiencing this afternoon is, of course, clouded by the remembrance of another old friend who has just gone to his rest, and who, at a slightly later date than Sir Clements Markham, also did much to urge me in the path that I have followed for a good many years. I refer, of course, to Stanley, whose death all interested in geography and all interested in Africa must deeply regret. I had the privilege of being Stanley's guest for some eight months on the Congo, at the time when he was commencing the foundations of what is now the Congo Free State. He was more concerned, at the time I knew him, in opening up the geography of those regions, and coming into contact in a thoroughly tactful and friendly way with the native tribes of those regions, and I trust I have never forgotten the lessons he impressed on me of the value of tact in dealing with the Africans. Wherever I went on the Congo—and still more in my later experiences in Uganda—I saw what a great impression Stanley had made on the natives by his strong sense of justice, his readiness to enter into their feelings, to talk with them, to hear their complaints, to endeavour to see that there should be no just ground of complaint. All this made a peculiar impression on me; and if I have met with any measure of success in Africa, I ascribe it, next to the advice and encouragement of my few friends at home, to my many friends on the African continent—my black friends, with many of whom, I am glad to say, I am able to keep up a pleasant correspondence to the present day. I shall not detain you any longer, because there are other proceedings to follow, but I think I have said enough to convince you that I appreciate to the full the honour that has been conferred on me; and I tender to the President and to my fellow-members of Council my really earnest expressions of thanks for the sympathy and kindness I have had from so many of them during all the years that I have devoted to African exploration.

The PRESIDENT: Mr. Macartney, the Patron's Medal has been awarded to Commander Robert F. Scott, the leader of our Antarctic Expedition, solely for his wonderful sledge journey to 82° 17′ S. last year, and when this resolution was taken we had not then received the news of his perhaps still more extraordinary journey into the inland of Victoria Land, which, of course, doubles the strength of his claim for our award. The award has been given with the approval of his Majesty the King. Captain Scott has always been himself the leader, and he has expected a great deal from his officers and from his men, but he has never himself failed to do as much work as his officers and men, to endure the same hardships, and to share them alike with his men. Hence he has won the absolute devotion of all on board the *Discovery*. Listen to a few things that have been said by them. One of the officers says, "It would have been a hard job to have found a better man. His sledging is wonderful; he covers distances that you would have said to be impossible, and without dogs. I bet there will be few who will go in for that sort of job, even if they do come out here." Another says, "There is not a man on board who has travelled as fast and does as much hard work as Captain Scott, nor is there a man who would not follow him anywhere wherever he chose to go." Another says, "My respect and admiration for Captain Scott as a leader are on a par with my appreciation of him as a friend, and that would take a lot of beating. Knowing him as you do, you will not be surprised to hear that he has made an even finer journey on the inland ice this summer. For his untiring energy and perseverance, there is not a man in the ship who does not admire and respect him." So with all the others. And then listen to what Captain Scott says of his men. "No words can express the splendid spirit in which our people work: no work was too heavy for them. I simply long to tell you of the thousand ways in which they showed it, and of the absolute kindly trust and confidence that existed throughout the ship. I should like you to have seen the way our people went to work this year, their mastery of detail, their cheerful acceptance of short rations, the splendid way in which they dragged; one and all went at it in the same spirit." It is with such a leader and such men that great work is done; and great work has been done. I have only alluded to a tithe of the services that Captain Scott has done for us. I have only alluded to the sledge journeys, because those are what the medal is awarded for, and I look upon Captain Scott as being in the very front rank of Arctic or Antarctic travellers. But he has done very much more for us as the most capable leader of this great expedition, which has met with such signal success mainly due to his high qualities and rare gifts. The Council has felt that such services deserve very special recognition, and has determined to present him with a special gold medal illustrative of the expedition, on his return, and they have also resolved to give replicas in silver to the officers and men. Now it only remains for me to present you with the Patron's Medal, to be kept by Mrs. Scott until the return of Captain Scott to England, when we shall give him a most hearty and warm reception.

The Right Hon. W. G. Ellison Macartney: I am desired by Mrs. Scott to express to you her deep sense of the high honour which you have conferred upon her son, Commander Scott. To be enrolled amongst those who have received the Patron's Medal is indeed one of those signal honours to which any explorer can look as the climax of his life, and I feel certain, if Commander Scott was here to-day, he would ascribe any measure of success that has attended this expedition, in the first place, to the great liberality with which it was fitted out by the Royal Geographical Society, aided by the Royal Society, and supplemented by those magnificent donations which came through private donors like Mr. Longstaff. But he would also, I have no doubt, say that to the confidence which was placed in him by those who followed, to the zeal and devotion and unselfishness with which every member of the expedition strove to do their best to merit that honour which has been conferred upon him by the Royal Geographical Society, is mainly owing the place which it will occupy in the future history of Arctic and Antarctic Expeditions. Sir Clements Markham, I beg again to express Mrs. Scott's sincere thanks for the high honour that has been conferred upon her son.

The President: Mr. Colbeck, the Council has felt that it owes a great debt of gratitude to your brother for the admirable way in which he has conducted the Relief Expeditions. Of course, the first one was very much the most important, because then we knew not what had become of the *Discovery*, or where she was; he had to find her. Moreover, it was an exceptionally bad year for navigation. He did his work splendidly, and we have already expressed our feeling on that subject to him; he did his work splendidly both as a sailor and as an ice-navigator. But I think he also deserves the highest credit for his selection of the officers, who have all done so admirably under him, and more especially for his selection and care of the crew, for they showed the greatest zeal during the time they were in the south; and, what is almost as important, they conducted themselves most respectably when they were in harbour, so that the *Morning* will certainly be a credit to the Mercantile Marine. Feeling all this, our Council has determined to present your brother, Captain Colbeck, with a piece of plate, which will be symbolical of these valuable services, and which will be presented to him on his return to England, I hope, at the same time as the special gold medal to Captain Scott.

Mr. COLBECK: On behalf of my brother, I thank you very much for the great honour you have done him in his absence by making this award. I am only sorry he is not here to receive it himself, and I shall have great pleasure in informing him of your determination. Had he been here, I am certain he would have taken but a small share of the credit, and given to his crew and officers the greater part, and also to your President for the kind counsel he gave him before he left.

The PRESIDENT: Señor Don Carlos Dominguez, sentimos admiracion por el joven officiale Argentino, Julian Irizar, por razon de su zelo y capacidad cuando recibió ordenes tomar bajo su direccion el buque *Uruguay*, rescatar los miémbros del expedicion Nordenskiöld. Saliendo de Buenos Ayres en Octobre del año pasado, antes del medio de Noviembre ha rescatado Dr. Nordenskiöld y sus compañeros de une isla, la tripulacion naufragada del *Antarctico* de una otra, una importante coleccion geologica de una otra. Era trabajo muy bien hecho, y el Consejo de nuestra Sociedad ha escojido Señor Irizar recibir una de nuestras recompensas llamada el "Gill Memorial." Tengo mucho placer poner la diploma en sus manos por trasmision al Señor Irizar.

The PRESIDENT: Señor Don Alberto Rey de Castro. El Consejo de nuestra Sociedad ha contemplado con aprobacion los descubrimientos geograficos hechos por orden de la Junta de Vias Fluviales del Gobierno Peruano, por los Señores Villalta, Cipriano y otros. Especialmente hemos notado los exploraciones del istmo Fitzgarrald, y en los valles del Tambopata y Ynambari. Con el deseo señalar nuestro aprecio de aquellos trabajos importantes, nuestro Consejo ha tomado la resolucion presentar al Señor Villalta una de las recompensas de nuestra Sociedad llamada el "Cuthbert Peek Grant." Agradesco que seria mi oficio poner la diploma en sus manos, preguntando vm mandarla a Lima por el Señor Villalta.

The PRESIDENT: The Back Grant has been awarded to Dr. Stein, for his valuable geographical work in Central Asia, and especially for his mapping in the Sarikol and Kuen-lun ranges. In Dr. Stein we have rare accomplishments. He is not only a surveyor and a good geographer, but also a good Sanscrit scholar. I have some hopes that he will be called upon to join the Tibetan Mission. I am sorry that no one is here to receive the award, but it will be forwarded to Dr. Stein.

The President then delivered his anniversary address (see p. 1).

The Report of the Council was then read; it will be issued with the next Year-book. The President then announced that the Council as proposed had been duly elected. The list is as follows, the names of new members, or of those changing office, being printed in *italics*:—

President: Sir Clements R. Markham, K.C.B., F.R.S., F.S.A. *Vice-Presidents:* Colonel G. Earl Church; Colonel Sir Thomas Hungerford Holdich, R.E., K.C.I.E., C.B.; *Sir Henry E. G. Bulwer*, G.C.M.G.; Admiral Sir F. Leopold McClintock, K.C.B., D.C.L., F.R.S.; Sir George S. Mackenzie, K.C.M.G., C.B.; Field-Marshal Sir Henry W. Norman, G.C.B., G.C.M.G., C.I.E. *Treasurer:* Edward L. Somers Cocks. *Trustees:* Right Hon. Lord Avebury, D.C.L., F.R.S.; Lord Belhaven and Stenton. *Honorary Secretaries:* Major Leonard Darwin, R.E.; James F. Hughes. *Foreign Secretary:* Sir John Kirk, K.C.B., G.C.M.G., F.R.S. *Councillors:* Admiral Sir Lewis A. Beaumont, K.C.M.G.; Prof. T. G. Bonney, D.SC., LL.D., F.R.S.; Admiral Sir James Bruce, K.C.M.G.; J. Annan Bryce; *Major Chas. F. Close*, R.E., C.M.G.; Prof. J. Norman

Collie, F.R.S.; *Captain Ettrick W. Creak*, R.N., C.B., F.R.S.; Prof. E. J. Garwood, F.G.S.; *F. H. H. Guillemard*, M.A., M.D.; *Admiral Sir R. Vesey Hamilton*, K.C.B.; D. G. Hogarth, M.A.; Colonel D. A. Johnston, C.B., R.E.; Sir Harry H. Johnston, G.C.M.G., K.C.B.; *Admiral Sir Albert Hastings Markham*, K.C.B.; Ll. W. Longstaff; *Colonel Sir Colin Scott-Moncrieff*, R.E., K.C.M.G., C.S.I.; General J. H. M. Shaw Stewart, R.E., F.R.S.E.; H. Yates Thompson, J.P.; *Colonel Sir Henry R. Thuillier*, R.E., K.C.I.E.; COLONEL J. K. Trotter, C.B., C.M.G., R.A.; Commander David Wilson-Barker, R.N.R., F.R.S.E.

THE ANNUAL DINNER.

The Annual Dinner of the Society was held in the evening at the Hôtel Métropole, Sir Clements R. Markham (the President) in the chair. There was a large and distinguished gathering, including Sir William Ramsay, Sir Montagu Ommanney, Sir Walter Phillimore, Sir Fleetwood Wilson, Prof. Henri Cordier (President of the Paris Geographical Society), the Agents-General for New Zealand and Queensland, the Consul-General for Sweden and Norway, Sir Harry Johnston, Sir George Vyvyan, Sir Horace Walpole, Sir Henry Yorke, Colonel Sir Thomas Holdich, Sir Thomas Blomefield, Field-Marshal Sir Henry Norman, Sir J. B. Robinson, General Sir Harry Prendergast, Admiral Sir Albert H. Markham, Admiral Sir Vesey Hamilton, Colonel Sir C. Scott-Moncrieff, Admiral Sir Lewis Beaumont, Mr. A. B. Kempe (Treasurer of the Royal Society), Major L. Darwin, Mr. J. F. Hughes, Mr. E. L. Cocks, Mr. Spenser Wilkinson, Colonel J. K. Trotter, Mr. L. Breitmeyer, and Captain Egerton. After the loyal toasts had been honoured—

The PRESIDENT proposed "The Medallists, Sir Harry Johnston and Captain Scott." Sir HARRY JOHNSTON replied for himself, and Captain EGERTON, in the absence of Prince Louis of Battenburg, responded on behalf of Captain Scott. The PRESIDENT, in proposing "The Antarctic Expedition," regretted that the President of the Royal Society was not able to be present, for that Society and the Geographical Society had worked together in the most friendly spirit. He did not propose success to the Antarctic Expedition—that was assured; but he proposed "a happy return." So far they had had only the mere outline of what had been done; but the full details would be most interesting and important from a geographical point of view. Lieut. E. H. SHACKLETON responded. Major L. DARWIN proposed "The Guests," and Prof. HENRI CORDIER and SIR WILLIAM RAMSAY responded. Sir HORACE TOZER submitted the toast of "The President and the Society," and Sir CLEMENTS MARKHAM replied.

Thirteenth Ordinary Meeting, May 30, 1904.—Sir CLEMENTS MARKHAM, K.C.B., F.R.S., President, in the Chair.

ELECTIONS.—*Henry Forsey Brion; G. W. Dawes; Robert Hinde Douglas; Major Gilbert Sutherland McDowell, R.E.; R. Talbot Kelly: J. McPherson; Rev. Edward Blackmore Rankin; C. A. E. Rodgers, M.A.; William Lord Smith.*

The paper read was:—

"A Journey to the North of the Argentine Republic." By Florence O'Driscoll, Esq.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Com. = Commerce.
C. Rd. = Comptes Rendus.
Erdk. = Erdkunde.
G. = Geography, Geographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
k. u. k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. = Memoirs, Mémoires.
Met. = Meteorological.
P. = Proceedings.
R. = Royal.
Rev. = Review, Revue.
S. = Society, Société, Selskab.
Sitzb. = Sitzungsbericht.
T. = Transactions.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Austria—Bosnia and Herzegovina. *Globus* 85 (1904): 221-226. **Kaiser.**

Landschaftliche Charakterbilder aus Bosnien und der Herzegowina. Von T. Kaiser. *With Illustrations.*

Austria—Herzegovina. *Trav. G. Tchèques* 3 (1902): pp. 71. **Daneš.**

Bevölkerungsdichtigkeit der Hercegovina. Von Dr. Georg V. Daneš. *Presented by the Author.*

See note in the Monthly Record for June.

Austria—Historical. **Pichler.**

Quellen u. Forsch. alten Gesch. u. G., Heft 2-4 (1902-1904): pp. 444.

Austria Romana. Geographisches Lexikon aller zu Römerzeiten in Östreich genannten Berge, Flüsse, Häfen, Inseln, Länder, Meere, Postorte, Seeen, Städte, Strassen, Völker. Von Fritz Pichler. *With Map.*

Balkan Peninsula—Cartography. *G.Z.* 10 (1904): 158-165. **Oestreich.**

Die Geschichte der Kartographie der südosteuropäischen Halbinsel. Von Dr. K. Oestreich.

Central Europe—Historical. **Kretschmer.**

Historische Geographie von Mitteleuropa. Von Prof. Dr. K. Kretschmer. (Handbuch der mittelalterlichen und neueren Geschichte. Herausgegeben von G. von Below und F. Meinecke. Abteilung iv.: Hilfswissenschaften und Altertümer.) München und Berlin: R. Oldenbourg, 1904. Size 10 × 6½, pp. viii. and 650. *Price* 15*s*. [To be reviewed.]

Europe. **Itschner.**

Lehrproben zur Länderkunde von Europa. Ein Beitrag zum Problem der Stoffgestaltung von Hermann Itschner. Leipzig und Berlin: B. G. Teubner, 1904. Size 9½ × 6½, pp. 278. *Price* 3*s*. 9*d*.

An outline of the geography of Europe as a sample of a school course on the subject.

Europe—Lakes. **Halbfass.**

Die Morphometrie der Europäischen Seen. Von Prof. Dr. W. Halbfass. (Sonderabdruck aus der Zeitschrift der Gesellschaft für Erdkunde zu Berlin. Jahrgang 1903, No. 8, 9, 10, und 1904, No. 3.) Size 10½ × 7, pp. [108]. *Presented by the Author.*

A tabularized summary of the results of the active limnological work prosecuted in Europe during the past dozen years.

France—Forests. *La G.*, *B.S.G. Paris* 9 (1904): 197-204. ———
Destruction des forêts et des parcs en France et à Paris depuis un Siècle. *With Plans.*

France—Provence. *B.S.G. Marseille* 27 (1903): 245-262. **Gaffarel.**
En Provence: La Ciotat et ses environs. Par M. le Prof. P. Gaffarel. *With Map.*

Germany. *VIII. Jahresb. G. Ges. Greifswald* (1900-1903): 141-243. **Elbert.**
Die Entwicklung des Bodenreliefs von Vorpommern und Rügen, sowie den angrenzenden Gebieten der Uckermark und Mecklenburgs während der letzten diluvialen Vereisung. Von J. Elbert. *With Plates.*

Germany. *G.Z.* 10 (1904): 168-169. **Henkel.**
Ist die deutsche Kleinstaaterei geographisch bedingt. Von Dr. L. Henkel.

Germany—Hessen. *G. M. aus Hessen* 3 (1903): 167-197 **Sievers.**
Kleine geographische Mitteilungen aus Hessen. Von Prof. Dr. Wilh. Sievers.

Germany—Hessen. *G. M. aus Hessen* 3 (1903): 116-166. **Zörb.**
Volksdichte der Grossherzoglich Hessischen Provinz Rheinhessen. Auf Grund der Volkszählung vom 1 Dezember 1900. Von Karl Zörb. *Map.*

Germany—Mecklenburg. *G. Anzeiger* 5 (1904): 25-26. **Wigand.**
Der Landverlust der Mecklenburgischen Küste. Von Dr. Georg Wigand.

Germany—Mountains. *G.Z.* 10 (1904): 13-25, 86-95, 134-143. **Hettner.**
Die deutschen Mittelgebirge. Versuch einer vergleichenden Charakteristik. Von A. Hettner.

Germany—Prussia—Debrong Lake. **Braun.**
Berichte Fischerei—V. Ostpreussen (1903-4): 29-30.
Beschreibung des Debrongsees. Von Dr. Gustav Braun. *Map. Presented by the Author.*

Germany—Races. *Quellen u. Forsch. alten Gesch. u. G.*, Heft 7 (1904): pp. 102. **Schmidt.**
Geschichte der deutschen Stämme bis zum Ausgange der Völkerwanderung. Von Dr. L. Schmidt. I. Abt. A.B., 1. Buch.

Germany—Rügen. *VIII. Jahresb. G. Ges. Greifswald* (1900-1903): 37-110. **Krause.**
Volksdichte und Siedelungsverhältnisse der Insel Rügen. Von Dr. R. Krause. *With Map.*

Germany—Saxony. **Richter.**
Litteratur der Landes- und Volkskunde des Königreichs Sachsen. Von P. E. Richter. Nachtrag 4. Herausgegeben von den Vereinen für Erdkunde zu Dresden und Leipzig. Dresden: A. Huhle, 1903. Size 9 × 6, pp. 220.

Greece. **Philippson.**
Ueber den Stand der geologischen Kenntnis von Griechenland. Von Prof. Dr. A. Philippson. (Comptes Rendus IX. Congrès géol. Internat. de Vienne 1903.) Wien, 1904. Size 10½ × 7½, pp. 371-382. *Presented by the Author.*

Iceland. **Vidalin.**
Trade of Iceland for the years 1900-1902. Foreign Office, Annual No. 3138, 1904. Size 10 × 6, pp. 18. *Price 1½d.*

Italy. **Deecke.**
Italy, a Popular Account of the Country, its People, and its Institutions (including Malta and Sardinia). By Prof. W. Deecke. Translated by H. A. Nesbitt. London: Sonnenschein & Co., 1904. Size 10½ × 7, pp. xii. and 486. *Maps and Illustrations. Presented by the Publishers.* [To be reviewed.]

Italy—Arno. **Oberti.**
Eugenio Oberti. Il bacino dell' Arno. Firenze, Tip. di M. Ricci, 1903. Size 9 × 6, pp. 72. *Presented by the Author.*

Cf. notice of paper by the same author in the *Journal* for January, 1903 (p. 74).

Jura Mountains—Geology. **Brückner.**
Notice Preliminaire sur la Morphologie du Jura Suisse et Français. Par Ed. Brückner. (Extrait des Archives des Sciences physiques et naturelles, 1902: 633-641). Geneva, 1902. Size 9 × 8½, pp. 9.

Mediterranean—Cyprus. **Foglietta.**
The Sieges of Nicosia and Famagusta in Cyprus. Related by Uberto Foglietta. Translated by Claude Delaval Cobham. London, 1903. Size 8½ × 5½, pp. 32. *Presented by the Translator.*

Mediterranean—Cyprus. **Hutchinson and Cobham.**
A Handbook of Cyprus. Compiled by Sir J. T. Hutchinson and C. D. Cobham, C.M.G. London: Waterlow & Sons. Size 7½ × 5, pp. xii. and 112. *Frontispiece and Maps. Price 2s. 6d. net.*

Norway. *La G., B.S.G. Paris* 9 (1904): 207–210. **Rabot.**
Débâcle glaciaire en Norvège. Par C. Rabot. *With Illustrations.*

Pyrenees—Water-power. *B.S.G. Com. Bordeaux* 30 (1904): 113–118. **Descombes.**
La Houille Blanche et les Indivisions de la Propriété dans les Pyrénées. Par P. Descombes.

Scandinavia. *B.S.G. Lille* 41 (1904): 13-30. **Synnestvedt.**
L'avenir économique de la Péninsule Scandinave. Par M. Synnestvedt.

Sweden. **Sundbärg.**
Sweden, its People and its Industry. Historical and Statistical Handbook published by order of the Government. Edited by Gustav Sundbärg. Stockholm: P. A. Norstedt & Söner, 1904. Size 9½ × 6½, pp. xii. and 1142. *Maps and Illustrations. Presented by the Bureau Central de Statistique de Suède.*

Turkey—Albania and Macedonia. *M.K.K.G. Ges. Wien* 46 (1903): 370–390. **Stransky.**
Reise durch Albanien und Makedonien im Sommer 1903. Von Gottfried Stransky.

United Kingdom—Ireland. *Geolog. Mag.* 10 (1903): 501-503. **Muff.**
On a Preglacial or Early Glacial Raised Beach in County Cork. By H. B. Muff.

United Kingdom—Rainfall. **Mill.**
On Distribution of Mean and Extreme Annual Rainfall over the British Isles. By Hugh Robert Mill, D.SC., LL.D. With an abstract of the discussion upon the paper. (Excerpt *Minutes of Proceedings of the Institution of Civil Engineers*, vol. clv. pp. 293–373.) London, 1904. Size 8½ × 5½, pp. 83.

United Kingdom—Rainfall. *Symons' Meteorolog. Mag.* 39 (1904): 41–43. ———
The Rainfall of the Winter Months. *With Diagrams.*

United Kingdom—Scotland. **Maclagan-Wedderburn.**
Seiches observed in Loch Ness. By E. Maclagan-Wedderburn. (Reprint from the *Proceedings of the Royal Society of Edinburgh*, vol. xxv. Part i.) Edinburgh: R. Grant & Son, 1904. Size 9 × 5½, pp. 2.

United Kingdom—Scotland. **Leyden.**
Journal of a Tour in the Highlands and Western Islands of Scotland in 1800. By John Leyden. Edited, with a Bibliography, by James Sinton. Edinburgh and London: W. Blackwood & Sons, 1903. Size 8 × 5½, pp. xviii. and 318. *Price 6s. net.*

The journal (a portion of which is in the form of letters to Sir W. Scott and other friends) is now printed for the first time, and gives an interesting view of the state of the highlands a century ago. The author left for India in 1803, and became in time a distinguished orientalist.

United Kingdom—Yorkshire. **Dakyns.**
P. Yorkshire Geolog. and Polytechnic S. 15 (1903): 52–58.
Notes on the Glacial Phenomena of part of Wharfedale, near Grassington, from my MS. written in 1878. By J. R. Dakyns.

United Kingdom—Yorkshire. **Howarth.**
P. Yorkshire Geolog. and Polytechnic S. 15 (1903): 46–51.
Notes on Boulder Markings on Mr. Kendall's map of the Glacier Lakes in the Cleveland Hills. By J. H. Howarth.

United Kingdom—Yorkshire. **Kendall.**
P. Yorkshire Geolog. and Polytechnic S. 15 (1903): 1–45.
The Glacier Lakes of Cleveland, [with] Supplementary observations. By P. F. Kendall. *With Maps and Illustrations.*

ASIA.

China—Grand Canal. **Gandar.**
Le Canal Impérial. Étude historique et descriptive par le P. Dominique Gandar, S.J. (Variétés Sinologiques No. 4.) Chang-hai, 1903. Size 10 × 6½, pp. 78. *Maps.*

China—Manchuria. *Rev. Française* 29 (1904): 155–165. **Barré.**
La Mandchourie. Par P. Barré. *With Map.*

China—Manchuria. *Fortnightly Rev.* 75 (1904): 561–571. **Beresford.**
From Harbin to Mukden. By Col. C. E. de la Poer Beresford.

China—Manchuria. *National G. Mag.* 15 (1904): 113–127. **Miller.**
Russian development of Manchuria. By H. B. Miller. *With Illustrations.*

China—Mongolia. **Campbell.**
China. No. 1 (1904). Report by Mr. C. W. Campbell, His Majesty's Consul at Wuchow, on a Journey in Mongolia. London: Eyre & Spottiswoode, 1904. Size 13 × 8½, pp. 44. *Map. Price* 10½*d.*

The journey is that of 1902, described before the Society last year (*Journal*, November, 1903).

China—Yunnan. **Litton.**
Report by Acting Consul [G.] Litton on a Journey in North-west Yünnan. China. No. 3, [1903]. Size 13 × 8½, pp. 23. *Price* 10½*d. Maps.*

See note in Monthly Record for June.

French Indo-China. **Pavie.**
Mission Pavie Indo-Chine 1879-1895. Géographie et Voyages. I. Exposé des Travaux de la Mission (Introduction, première et deuxième périodes—1879 à 1889). Par Auguste Pavie. Paris: E. Leroux, 1901. Size 11 × 9, pp. 334. *Map and Illustrations. Presented by M. Pavie.*

India. **Cotton.**
New India, or India in Transition. By Sir H. J. S. Cotton, K.C.S.I. New Edition. London: Paul & Co., 1904. Size 8 × 5, pp. x. and 252. *Price* 3*s.* 6*d. net. Presented by the Publishers.*

The author's object in writing this book is "to draw attention to the great changes which are taking place in India . . . and to the spirit which, in my judgment, should inspire our policy in relation to them."

India. **Dutt.**
India in the Victorian Age—an Economic History of the People. By R. Dutt. London: Paul & Co., 1904. Size 8½ × 5½, pp. xxii. and 628. *Price* 10*s.* 6*d. net. Presented by the Publishers.*

Largely an indictment of British policy in regard to Indian economic questions, which, the author holds, is progressively impoverishing the people.

India—Himalayas. **Wood.**
Report on the Identification and Nomenclature of the Himalayan Peaks as seen from Katmandu, Nepal. By Captain H. Wood. With Preface by Col. St. G. Gore, C.S.I. Calcutta: 1904. Size 13½ × 8½, pp. iv., 8, and iv. *Map and Profiles.*

Captain Wood claims that his bearings and photographs prove that Mount Everest, as seen from both Kaulia and Mahadeo Pokra, is the least imposing of all the great peaks; that it stands quite apart from the Gaurisankar group; and that the group photographed by Dr. Boeck (*Journal*, vol. xxi. p. 295) is not the Gaurisankar seen from the parade ground at Katmandu, but another group considerably further west.

Japan. **Clement.**
A Handbook of Modern Japan. By E. W. Clement. London: Paul & Co., 1904. Size 7½ × 5, pp. xiv. and 396. *Maps and Illustrations. Price* 6*s. net. Presented by the Publishers.*

Useful as presenting a general view of Japan, its people, history, literature, and systems of law and government; in fact, all the points on which information is likely to be sought either by the general reader or the visitor to the country. It is not meant, however, to serve the purpose of a guide-book.

Malay Archipelago—Java. **Louw.**
De Java-Oorlog van 1825-30 door P. J. F. Louw. Derde Deel. Batavia: Landsdrukkerij; 's Hage: M. Nijhoff. 1904. Size 11 × 7½, pp. xxii. and 704. *Maps. Presented by the Bataviaasch Genootschap van Kunsten en Wetenschappen.*

Philippine Islands. *National G. Mag.* 15 (1904): 91–112. **Gannett.**
The Philippine Islands and their People. By H. Gannett. *With Illustrations.*

Siam. *B. Comité l'Asie Française* 4 (1904): 76–85. **Caix.**
Un nouveau traité franco-siamois. Par Robert de Caix. *With Maps.*

See note in the Monthly Record for May.

Siam. *Rev. Française* 29 (1904): 129–144. **Salaignac.**
Le nouveau traité avec le Siam. Par A. Salaignac. *With Map.*

Western Asia. *G.Z.* 10 (1904): 165–168. **Zimmerer.**
Die wirtschaftliche Bedeutung West-Asiens. Von Prof. Dr. H. Zimmerer.

AFRICA.

Africa. **Gibbons.**
Africa from South to North through Marotseland. By Major A. St. H. Gibbons. 2 vols. London and New York: John Lane, 1904. Size 9 × 6, pp. (vol. i.) xx. and 276; (vol. ii.) xxii. and 298. *Map and Illustrations. Price* 32*s. net. Presented by the Publisher.* [To be reviewed.]

Cape Colony—Meteorology. *T. South African Philos. S.* 14 (1903): 403–408. **Marloth.**
Results of Experiments on Table Mountain for ascertaining the amount of Moisture deposited from the S.E. Clouds. By R. Marloth.
See note in the Monthly Record (*ante*, p. 96).

Central Africa—Lakes. *Mouvement G.* 21 (1904): 157–160. **[Wauters.]**
L'Écoulement des Lacs Kivu et Bangweolo. Par A. J. W. *Map.*

Central Sudan. *La G., B.S.G. Paris* 9 (1904): 161–176. **D'Huart.**
Le Tchad et ses habitants. Notes de Géographie physique et humaine. Par — D'Huart.

Congo. *Trav. G. Tchèques* 1 (1901): pp. 142. **Švambera.**
Kongo. Napsal Dr. V. Švambera. I. *Presented by the Author.*

Congo State—Welle. *Mouv. G.* 21 (1904): 125–126. **Lemaire.**
Le Cours de l'Uele. Par le Commandant Ch. Lemaire.
Records a large number of determinations of position made by Capt. Lemaire.

Egypt—Baharia Oasis. **Ball and Beadnell.**
Baharia Oasis: its Topography and Geology. By John Ball and Hugh J. L. Beadnell. Cairo, 1903. Size 11 × 7½, pp. 84. *Maps and Plates. Presented by the Director-General, Survey Department, Egypt.*

Egypt—Irrigation. **Willcocks.**
The Assuan Reservoir and Lake Moeris. By Sir William Willcocks. London: 1904. Size 11 × 7, pp. 35. *Plates. Presented by the Author.*
Noticed in the Monthly Record, *ante*.

Egypt and the Sudan. **Cromer.**
Egypt, No. 1 (1904). Reports by His Majesty's Agent and Consul-General on the Finances, Administration, and Condition of Egypt and the Soudan in 1903. London: Eyre & Spottiswoode, 1904. Size 13½ × 8½, pp. iv. and 100. *Price* 10½*d.*
See note in the Monthly Record.

French Congo. *Questions Dipl. et Colon.* 17 (1904): 233–242. **Terrier.**
La réorganisation du Congo français et la mission Lenfant. Par A. Terrier. *With Map.*

French Congo. *La G., B.S.G. Paris* 9 (1904): 232–234. ——
Reconnaissances géographiques dans le bassin de l'Ogôoué. *With Map.*

German E. Africa—Uhehe. *Beitr. Kolonialpolitik* 5 (1903–4): 309–322. **Schlagintweit.**
Die Tegernseen in Uhehe. Von Major Max Schlagintweit.

German S.W. Africa—Afforestation. *Globus* 85 (1904): 134–136. **Gessert.**
Zur Aufforstungsfrage in Südwestafrika. Von Ferd. Gessert.

Kamerun. *Globus* 85 (1904): 1–6, 73–77. **Engelhardt.**
Eine Reise durch das Land der Mwele und Esum, Kamerun. Von Hauptmann P. Engelhardt. *With Map and Illustrations.*

Kamerun—Exploration. *Beitr. Kolonialpolitik* 5 (1903–4): 289–294. **Moisel.**
Stand der Geographischen Erforschung Kameruns Ende 1903. Von M. Moisel. *Map.*

Komoro Islands. *Rev. Colon.*, No. 16 (1904): 387–406. **Plantier.**
La Grande-Comore; sa colonisation. Par le Dr. Nicolas du Plantier. *With Map.*

Nigeria—Economic Products. **Dunstan.**
Northern Nigeria. Colonial Reports, No. 26, December 18, 1903. Report on a Series of Mineral and Vegetable Products. By Prof. W. R. Dunstan. Size 9½ × 6, pp. 26. *Price* 2*d.*

North-east Africa. *Z. Ges. Erdk. Berlin* (1904): 89–131. **Erlanger and Sprigade.**
Bericht über meine Expedition in Nordost-Afrika in den Jahren 1899–91. Von Carlo Freiherr v. Erlanger.
Geographische Ergebnisse der Expedition von Carlo Frhr. v. Erlanger in Nordost-Afrika in den Jahren 1899–1901. Von P. Sprigade. *With Maps. Also separate copy, presented by Herr P. Sprigade.* [See note in Monthly Record for June.]

Somaliland—Trade. ———
Report on the Trade and Commerce of the Somaliland Protectorate, 1902–3. Africa, No. 2 (1904). Size 13 × 8½, pp. 45. *Price 5d.*

West Africa. *Scottish G. Mag.* **20** (1904): 134–143. **Morel.**
The Economic Development of West Africa. By Edmund D. Morel.

Paper read at the Southport meeting of the British Association.

West Africa—Early Travel. **Jobson.**
The Golden Trade or a Discovery of the River Gambra, and the Golden Trade of the Aethiopians. By Richard Jobson. 1623. Now reprinted for the First Time. Edited by Charles G. Kingsley, with woodcut ornamentation based on West African designs by R. Morton Nance. Teignmouth: E. E. Speight & R. H. Walpole, [*not dated*]. Size 9 × 7, pp. xviii. and 210.

The first of a series of reprints of old travels, produced in excellent style.

NORTH AMERICA.

Canada—Geology. *Petermanns M.* **50** (1904): 20–28, 47–55. **Haas.**
Zur Geologie von Canada. Von Prof. Dr. Hippolyt Haas. *With Map.*

United States. *J. Geology* **12** (1904): 34–39. **White.**
The Appalachian River *versus* a Tertiary Trans-Appalachian River in Eastern Tennessee. By C. H. White.

United States—Arizona. *J. Franklin I.* **157** (1904): 293–311. **Carter.**
The Petrified Forests and Painted Desert of Arizona. By Prof. Oscar C. S. Carter. *Map and Illustrations.*

United States—Colorado. *J. Geology* **12** (1904): 30–33. **Henderson.**
Arapahoe Glacier in 1903. By J. Henderson. *With Diagram.*

United States—Great Basin. **Davis.**
B. Museum Comparative Zoology **42** (1903): 129–178.
The Mountain Ranges of the Great Basin. By W. M. Davis. *With Illustrations.*

United States—Irrigation. *National G. Mag.* **15** (1904): 15–30. **Newell.**
The Reclamation of the West. By F. H. Newell. *With Maps and Illustrations.*

United States—Maryland. **McCormac.**
White Servitude in Maryland, 1634–1820. By E. I. McCormac. (Johns Hopkins University Studies, Series xxii., Nos. 3–4.) Baltimore, 1904. Size 10 × 6, pp. 112.

United States—Maryland. **Steiner.**
Beginnings of Maryland, 1631–1639. By R. C. Steiner, PH.D. (Johns Hopkins University Studies, Series xxi., Nos. 8–10.) Baltimore, 1903. Size 10 × 6, pp. 112.

United States—Mississippi. *Science* **19** (1904): 631–639. **Taylor.**
Levees, Outlets and Reservoirs as Means for Protection against Overflow of the Alluvial Lands of the Mississippi Valley below Cairo. By R. S. Taylor. *With Map.*

United States—Mississippi—Historical. **Ogg.**
The Opening of the Mississippi. A Struggle for Supremacy in the American Interior. By F. A. Ogg. New York: the Macmillan Co., 1904. Size 8 × 5½, pp. xii. and 670. *Maps. Price 8s. 6d.*

Although dealing to some extent with ground covered by the works of Winsor, Parkman, and others, this will be useful to the student and general reader from the fact that it supplies a broad view of the history of early European enterprise in the Mississippi basin, without entering into the minute details to be found in more pretentious historical works.

United States—New Hampshire. *J. Geology* **12** (1904): 1–14. **Perry.**
Geology of Monadnock Mountain, New Hampshire. By J. H. Perry. *With Map and Illustrations.*

CENTRAL AND SOUTH AMERICA.

Argentine Republic. *Deutsch. Rundschau G.* 26 (1904): 251-255. **Cappus.**
Die Wassersperren des Rio Primero in Argentinien. Von W. Cappus. *With Map and Illustrations.*

On the regularization of the Rio Primero near Córdoba by a dam, for the purposes of irrigation and the avoidance of destructive floods.

Argentine Republic—Altitudes. *B.A. Nac. Ci. Córdoba* 13 (1892): 45-150. **Seelstrang.**
Alturas de la Républica Argentina. Por Arturo Seelstrang.

Argentine Republic—Andes. *B.A. Nac. Ci. Córdoba* 13 (1892): 5-44 **Bodenbender.**
Sobre el terreno jurásico y cretáceo en los Andes argentinos entre el rio Diamante y el rio Limay. Por Guillermo Bodenbender.

Bolivia and Brazil. ———
Monthly B. Internat. Bureau American Rep. 16 (1904): 642-647.
Final Decision of the Acre Question. Boundary Treaty between Bolivia and Brazil.

Brazil—Climatology. *Pet. M., Ergänzungsheft* 145 (1904): pp. 48. **Voss.**
Beiträge zur Klimatologie der südlichen Staaten von Brasilien. Von E. L. Voss. *Map.*

Brazil—Meteorology. *Meteor. Z.* 21 (1904): 62-72. **Hann.**
Die Beobachtungs-Ergebnisse am meteorologischen Observatorium erster Ordnung zu Curityba, Staat Paraná, Brasilien. Von J. Hann.

Central America—Canal. *Fortnightly Rev.* 75 (1904): 670-683. **Uzanne.**
The Inter-Oceanic Canal—Nicaragua or Panama? By Octave Uzanne.

Chile—Chiloé. **Webers.**
Chiloé: Su estado actual.—Su colonizacion.—Su porvenir. Por Alfredo Webers. Santiago de Chile, 1903. Size 10½ × 7½, pp. 194. *Map.*

Chile—Valparaiso. **Fagalde.**
Alberto Fagalde. El puerto de Valparaiso i sus obras de mejoramiento. Size 11 × 8, pp. 158. *Plan and Illustrations. Presented by the Chilean Hydrographic Office.*

Ecuador. *Z. Ges. Erdk. Berlin* (1904): 49-61, 132-150. **Meyer.**
Reisen im Hochland von Ecuador. Von Prof. Dr. H. Meyer.

See note in the *Journal* for December, 1903 (p. 701).

Falkland Islands and Tierra del Fuego. **Andersson.**
Ann. S. Científica Argentina 55 (1903): 19-22.
Trabajos efectuados en las Islas Malvinas y en la Tierra del Fuego por la Expedición sueca al Polo Sud. Por J. G. Andersson.

Jamaica. **Ford and Finlay.**
The Handbook of Jamaica for 1904. Compiled . . . by J. C. Ford and A. A. C. Finlay. London: E. Stanford. 1904. Size 8½ × 6, pp. viii. and 532. *Map. Price 7s. 6d. net. Presented by the Publisher.*

Martinique. *American J. Sci.* 16 (1903): 270-281. **Hovey.**
The New Cone of Mont Pelé and the Gorge of the Rivière Blanche, Martinique. By Edmund O. Hovey. *Illustrations.*

Salvador. *Ann. Museo Nacional* 1 (1904): 298-308. **Guzmán.**
Repoblación de los bosques salvadoreños. Obra inedita del Dr. David J. Guzmán.

South America—Watershed. *G.M. aus Hessen* 3 (1903): 1-115. **Wagner.**
Die Wasserscheide in Südamerika südlich von 40° S. Br. Eine quellenkritische Studie über den Chilenischargentinischen Grenzstreit und dessen geographische Ergebnisse. Von Heinrich Wagner.

AUSTRALASIA AND PACIFIC ISLANDS.

Marcus Island. **Bryan.**
Occasional Papers, Bernice Pauahi Bishop Museum 2 (1902): 77-139.
A Monograph of Marcus Island. By William Alanson Bryan. *Map and Illustrations.*

New Britain. *Globus* **85** (1904): 136-140. **Rascher.**
Eine Reise quer durch die Gazelle-Halbinsel (Neu-Pommern). Von P. M. Rascher.

New Britain. **Wolff.**
Emil Wolff. Die Durchquerung der Gazelle-Halbinsel, Bismarckarchipel. (Abteilung Berlin-Charlottenburg der Deutschen Kolonial-Gesellschaft. Verhandlungen 1903-1904, Band viii., Heft 2.) Berlin: D. Reimer (Ernst Vohsen), 1904. Size 9 × 6, pp. 32-54. *Price* 63 *pf.* *Presented by the Publisher.*

See note in Monthly Record for June.

New Guinea. *J. Camera Club* 18 (1904): 30-33. **Abbot**
Three Years in New Guinea. By the Rev. W. H. Abbot.

Pacific and Indian Oceans. **Tolna.**
C^{te} R. Festetics de Tolna. Chez les Cannibales. Huit ans de croisière dans l'Océan Pacifique à bord du yacht *Le Tolna.* The same. Vers l'écueil de Minicoy après huit ans dans l'Océan Pacifique et Indien à bord du yacht *Le Tolna.* Paris: Plon-Nourrit et C^{ie}, 1903-1904. Size 11 × 7½, pp. iv., 408, and 396. *Maps and Illustrations. Price* £1 12*s.*

The islands visited included, among others, the Melanesian groups of the New Hebrides, the Solomon islands, New Britain, etc., the voyage ending with a shipwreck and detention at Minicoy. There are numerous photographs, many of native types.

South Australia. ———
A Short Review of Mining Operations in the State of South Australia during the year 1903. Adelaide, 1904. Size 10 × 6½, pp. 12.

POLAR REGIONS.

Antarctic—German Expedition. *Z. Ges. Erdk. Berlin* (1901): 14-41. **Drygalski.**
Bericht über Verlauf und Ergebnisse der Deutschen Südpolar-Expedition. Von E. von Drygalski. *With Maps and Illustrations.*

Antarctic—Scottish Expedition. *Scottish G. Mag.* **20** (1904): 57-66, 113-133. ———
First Antarctic Voyage of the *Scotia. Illustrations.*

The second instalment consists of the scientific reports of the leader and staff.

Arctic. *B. Musée Océanogr. Monaco, No.* **2** (1904): pp. 30. **Bénard.**
Projet d'Expédition Océanographique double à travers le Bassin Polaire Arctique. Par M. Charles Bénard. *Illustrations.*

Arctic—Greenland Sea. *Ann. Hydrographie* 32 (1904): 49-69. **Brennecke.**
Beziehungen zwischen der Luftdruckverteilung und den Eisverhältnissen des Ostgrönländischen Meeres. Von Wilhelm Brennecke.

Noticed in the Monthly Record, *ante*, p. 99.

Arctic—Meteorology. *La G., B.S.G. Paris* **9** (1904): 177-187. **Simmons.**
Observations météorologiques faites dans l'archipel polaire Américain par l'expédition Sverdrup. Par H. G. Simmons.

Arctic—Peary Expedition. *B.G.S. Philadelphia* 4 (1904): pp. 48. **Peary.**
Field Work of the Peary Arctic Club, 1898-1902. By Commander R. E. Peary. *Illustrations.*

MATHEMATICAL GEOGRAPHY.

Changes of Level. *Veröffentl. Preuss. Geod. I.* **14** (1904): 42 pp. **Schumann.**
Ergebnisse einer Untersuchung über Veränderungen von Höhenunterschieden auf dem Telegraphenberge bei Potsdam. Von Dr. R. Schumann.

Measurement of Altitudes. **Liznar.**
Die barometrische Höhenmessung. Mit neuen Tafeln, welche den Höhenunterschied ohne Zuhilfenahme von Logarithmentafeln zu berechnen gestatten. Von J. Liznar. Leipzig und Wien: F. Deuticke, 1904. Size 10 × 7, pp. 48. *Price* **2m.** *Presented by the Publisher.*

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Earth Temperature. *Meteor. Z.* **21** (1903): 50-62. **Woeikof.**
Probleme der Bodentemperatur. Typen ihrer vertikalen Verbreitung. Verhältnis zur Lufttemperatur. Von A. Woeikof.

Geology. **Chamberlin and Salisbury.**
Geology. By T. C. Chamberlin and R. D. Salisbury. Vol. i.—Geologic Processes and their results. New York: H. Holt & Co., 1904. Size 9 × 6, pp. xx. and 654. *Maps and Illustrations. Presented by the Publishers.*

Geo-physics. *C. Rd.* **138** (1904): 712–714. **Launay.**
Sur la répartition des éléments chimiques dans la terre et sa relation possible avec leurs poids atomiques. Note de L. De Launay.

Glacial Epoch. *VIII. Jahresb G. Ges. Greifswald* (1900–1903): 1–16. **Credner.**
Das Eiszeit-Problem. Wesen und Verlauf der diluvialen Eiszeit. Ein Vortrag von R. Credner.

Glaciation. **Crammer**
Eis- und Gletscherstudien. Von Hans Crammer. Stuttgart, 1903. Size 9 × 6½, pp. 116. *Illustrations. Presented by the Author.*
See note in Monthly Record for April (p. 526, *ante*).

Glaciers. *Deutsch. Rundschau G.* **26** (1904): 241–251. **Neuber.**
Gletscherarbeit. Von A. Neuber. *With Illustration.*
On glacial erosion, etc., illustrated from personal observation.

Hydrology—Ground-water. *Meteorolog. Z.* **20** (1903): 364–367. **Weyde.**
Die Abhängigkeit des Grundwasserstandes von dem Luftdrucke, dessen Steigen und Fallen während eines Tages (Flut und Ebbe). Von Prof. F. Weyde.

Hydrology—Whirlpools. *C. Rd.* **138** (1904): 915–917. **Brunhes.**
Sur le sens de rotation des tourbillons d'eaux courantes dans l'Europe Centrale. Note de J. Brunhes.
Cf. note on Messrs. Brunhes' former researches, vol. xxiii. p. 526.

Meteorology. **Garriott.**
Weather Folk-Lore and Local Weather Signs. Prepared by E. B. Garriott. (U.S. Department of Agricultural. Weather Bureau. Bulletin No. 33). Washington, 1903. Size 9½ × 6, pp. 154. *Charts. Presented by the U.S. Weather Bureau.*

Meteorology. **Lapparent.**
La Pluie et Le Beau Temps. Par A. De Lapparent. Paris, 1904. (Extrait du Correspondant). Size 9½ × 6, pp. 23. *Presented by the Author.*

Meteorology—Evaporation. *Meteorolog. Z.* **20** (1903): 380–384. **Okada.**
Vergleichende Messungen der Verdunstung des Meerwassers und des Süsswassers. Von T. Okada.

Meteorology—"Pola" Expedition. *Meteorolog. Z.* **20** (1903): 347–360. **Hann.**
Die meteorologischen Ergebnisse der Expedition Sr. M. Schiff "Pola" in das Rote Meer 1895–96 und 1897–98. Von J. Hann.

Meteorology—Rain Register. **Mill.**
Pocket Rain Register. Designed by Dr. H. R. Mill. London, 1903. Size 9 × 6, pp. 32.
Contains hints for observing rainfall.

Oceanography. *B. Musée Océanograph. Monaco No.* **9** (1904): pp. 16. **Thoulet.**
Les lois physiques de l'Océan et leurs relations avec les êtres qui l'habitent. Par J. Thoulet.

Oceanography. *C. Rd.* **138** (1904): 527–529. **Thoulet.**
Méthode physique et chimique de reconnaissance et de mesure des courants sous-marins profonds. Note de M. Thoulet.

Oceanography—Barents Sea. *Petermanns M.* **50** (1904): 35–46. **Breitfuss.**
Ozeanographische Studien über das Barents-Meer, auf Grund der Untersuchungen der wissenschaftlichen Murman-Expedition. Von Dr. L. Breitfuss. *With Map and Profiles.*

Phyto-geography. *National G. Mag.* **15** (1904): 47–49. **Russell.**
Timberlines. By I. C. Russell.
Noticed in the Monthly Record for June.

Phyto-geography—Chinchona. *La G., B.S.G. Paris* **9** (1904): 192–196. **Flahault**
Les Quinquinas, leur patrie, leur introduction dans les diverses parties du monde. Par C. Flahault. *With Diagram.*

Sand-dunes. *National G. Mag.* **15** (1904): 43–47. **Hitchcock.**
Controlling Sand-dunes in the United States and Europe. By A. S. Hitchcock. *With Illustrations.*

Terrestrial Magnetism. **Fritsche.**

Atlas des Erdmagnetismus für die Epochen 1600, 1700, 1780, 1842 und 1915. Von Dr. H. Fritsche. Riga: 1903. Size 14½ × 9, pp. 26. *Tables.*

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Ethnology. *Indian Antiquary* **32** (1903): 381–389, 417–426; **33** (1904): 10–16. **Lévi.**

Notes on the Indo-Scythians. By Sylvain Lévi. (Extracted and rendered into English by W. J. Philipps.)

Historical. *B.S.R. Belge G.* **28** (1904): 5–15. **[Reclus.]**

Les Grandes Voies historiques. *With Map.*

Historical—French Missions. **Piolet.**

La France au dehors. Les Missions Catholiques Françaises au XIX^e Siècle, publiées sous la direction du Pére J.-B. Piolet, S.J. Avec la collaboration de toutes les Sociétés de Missions. 6 vols. Paris: A. Colin [vols. I.–III. not dated], 1902–1903. Size 11½ × 7½, pp. (vol. i.) xcvi. and 432; (vol. ii.) 512; (vol. iii.) 504; (vol. iv.) 512; (vol. v.) 512; (vol. vi.) 520. *Illustrations.*

Historical—Southern Continent. **Lee.**

The Great South Land. A Point for Historians and Geographers. By Ida Lee. (From the *Empire Review*, February, 1904, pp. 71–80.) Size 10 × 6½.

Suggests that the first discovery of the Australian continent was due to Sebastian Cabot in 1499. While showing an extensive acquaintance with the literature of the subject, the writer is of course venturing on the ground of pure hypothesis, and, whatever might be said for the view that some southern land was reached by Cabot in the year named, the idea that this was Australia is, to say the least, an extremely bold flight of imagination.

History of Geography—Alphonse de Saintonge. **Musset.**

La Cosmographie, avec l'espère et régime du soleil et du nord. Par Jean Fonteneau dit Alfonse de Saintonge. Publiée et annotée par G. Musset. (Recueil de Voyages et de Documents pour servir à l'Histoire de la Géographie depuis le XIII^e jusqu'à la fin du XVI^e siècle XX.) Paris: E. Leroux, 1904. Size 11 × 7½, pp. 600. [To be reviewed.]

Population Maps. **Brückner.**

Ueber Karten der Volksdichte. Von Prof. Dr. Ed. Brückner. 6 pp. *Map.* (Separatabdruck aus Z. für Schweiz. Statistik, 1904.)

BIOGRAPHY.

Mathews. **Coolidge.**

Un Pionnier des Alpes Françaises, William Mathews. Par W.-A.-B. Coolidge. Lyon, 1904. Size 9½ × 6, pp. 23. *Presented by the Author.*

Radde. *Leopoldina* **39** (1903): 121–128; 135–139. **Drude and Taschenberg.**

Gustav Radde, sein Leben und Wirken. Von Prof. Dr. O. Drude und Prof. Dr. O. Taschenberg.

GENERAL.

British Empire. **Young.**

An Address on Imperial Federation. By Sir Frederick Young. London, 1903. Size 8½ × 5½, pp. 23.

British Empire—Cotton. *J.S. Arts* **52** (1904): 439–457. **Emmott.**

Cotton-growing in the British Empire. By A. Emmott, M.P.

Educational—Wall-maps. **Wethey.**

Available School Wall-maps. By E. R. Wethey. [From the *School World*, September, 1903, pp. 324–326.] London: Macmillan & Co., 1903. Size 11 × 8.

Encyclopædia. **Meyer.**

Meyers Grosses Konversations-Lexikon. Sechste Auflage. Sechster Band. Erdeessen bis Franzén. Leipzig und Wien, Bibliographisches Institut, 1904. Size 10 × 6½, pp. 908. *Maps and Illustrations.*

Exhibition. ———

Catalogue of the Geographical Exhibition arranged by the Geographical Association, and shown in London and elsewhere in 1904. A supplement to the *Geographical Teacher*, vol. ii. London: G. Philip & Son. Size 10 × 6½, pp. 38. *Price 6d. net.* See note in the March number (p. 393).

German Colonies. ———

Das Ueberseeische Deutschland. Die deutschen Kolonien in Wort und Bild. Nach dem neuesten Stand der Kenntniss bearbeitet von Hauptmann a. D. Hutter, Dr. R. Büttner, Prof. Dr. Karl Dove, Direktor A. Seidel, Director C. v. Beck, H. Seidel, Dr. Reinecke, Kapitänleutnant Deimling. Stuttgart, Berlin, Leipzig: Union Deutsche Verlagsgesellschaft, [not dated]. Size 9½ × 6½, pp. viii. and 680. *Maps and Illustrations.*

A good general account of the German possessions abroad, dealing with the history of their acquisition, their surface features and products, inhabitants and their mode of life, and so on. Each section is by a recognized authority on its subject.

German Colonies—Bibliography. **Brose.**

Die deutsche Koloniallitteratur im Jahre 1902. Zusammengestellt von M. Brose. Sonder-Heft der Beiträge zur Kolonialpolitik und Kolonialwirtschaft. Berlin: W. Süsserott, 1904. Size 9½ × 6½, pp. 64.

German Colonies—Place-names. *Deutsch. Kolonialblatt* 14 (1903): 453–454. ———

Grundsätze für die Namengebung, Namenübersetzung, Schreib- und Sprechweise der geographischen Namen in den deutschen Schutzgebieten.

Noticed in *Journal*, February, 1904 (p. 265).

Scientific Research. *Univ. B.* 5 (1904): pp. 24. **Russell.**

Research in State Universities. By Prof. Israel C. Russell.

Statistics. *Petermanns M.*, *Ergänzungsheft*, No. 146 (1904): pp. 158. **Supan.**

Die Bevölkerung der Erde. XII. Amerika, Afrika, und Polarländer. Bevölkerung der Erde um die Jahrhundertwende. Von A. Supan. *With Maps.*

The statistics for Africa are particularly valuable as supplying the first trustworthy estimate, in detail, of the areas, etc., of the political divisions of the continent, since the conclusion of its partition among the Powers.

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

England and Wales. **Bartholomew.**

The Survey Atlas of England and Wales. A series of eighty-four plates of maps and plans, with Descriptive Text, illustrating the Topography, Physiography, Geology, Climate, and the Political and Commercial Features of the Country. Designed by and prepared under the direction of J. G. Bartholomew, F.R.S.E., F.R.G.S. Parts xv. and xvi. Edinburgh: John Bartholomew & Co., 1903. *Price* 2*s.* 6*d.* *each part. Presented by the Publishers.*

These parts contain plates 23, 24, 43, 48-50, 64, and 65, forming the following sections of the 2-miles-to-the-inch general map of England and Wales: xii. (York and Leeds), xiii. (Blackburn and Halifax), xxxii. (Peterborough), xxxvii. (Northampton and Bedford), xxxviii. (Stratford-on-Avon), xxxix. (Hereford and Malvern), liii. (Salisbury), liv. (Bath and Wells).

England and Wales. **Ordnance Survey.**

ORDNANCE SURVEY OF ENGLAND AND WALES:—Sheets published by the Director-General of the Ordnance Survey, Southampton, from June 1 to 30, 1904.

1 inch:—

(Third edition) in outline, 7, 11, 286, 1*s.* *each* (engraved).

(Third edition) with hills in brown or black, 7, 11, 286, 315, 1*s.* *each* (engraved).

District map of Llandovery, with roads printed in colour; mounted on linen, folded in cover or flat in sheets, 1*s.* 6*d.*

6-inch—County Maps (first revision):—

Gloucestershire, 67 N.W. **Herefordshire**, 2 N.E., 6 S.W., 11 S.E. **Leicestershire**, 15 S.E., 18 S.W., 26 N.W., N.E., 32 N.W., 35 S.W., 38 N.W., N.E. **Radnorshire**, 15 N.W., S.E., 17 N.W. **Shropshire**, 77 N.E., 79 S.E. **Somersetshire**, 2 N.W., S.E., 4 S.W., 14 S.W., 17 S.W., 18 N.W., 19 S.E., (24 N.E. and 25 N.W.), 25 N.E., 26 S.E., 28 N.E., S.E., 29 S.W., 43 S.E., 80 S.E., 81 S.W. **Warwickshire**, 9 N.E., 10 S.E. **Worcestershire**, 20 N.W. (First Revision of 1891 Survey). **Yorkshire**, 289 N.E., 297 S.W. 1*s.* *each*.

25-inch—County Maps (first revision):—
Brecknockshire, XVI. 5, 6, 7, 11, 15, 16; XXII. 12; XXIII. 2, 3, 4, 6, 7, 8, 10, 11, 12. **Devonshire,** I. 13, 14, 15, 16; II. 10, 13; IV. 2, 3, 4, 6, 7, 8, 10, 11, 12, 14, 15, 16; V. 2, 3, 4, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16; VI. 1, 2, 5, 6, 9, 10, 13, 14; VIII. 1, 2, 3, 4, 5, 6, 7, 8. **Herefordshire,** VIII. 10, 14; XXXIV. 9, 13, 14; XXXIX. 9, 12, 13, 14, 15; XL. 8, 10; XLI. 6, 9, 10; XLV. 3, 4, 6, 7, 8, 9, 10, 11, 12; XLVI. 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12; XLVII. 1, 2, 5, 9, 10. **Leicestershire,** II. 3, 10, 14; VII. 1, 2, 5; XIV. 7, 15; XXI. 2, 14, 15; XXXIX. 5; XLVI. 4. **Lincolnshire,** CXXX. 3, 7, 8, 12, 15, 16; CXXXIX. 1, 2, 3, 8, 9, 11, 12, 14, 15, 16; CXLV. 3, 4, 8; CL. 3, 4, 7, 12. **Radnorshire,** XXXV. 6, 7, 11, 16; XXXVI. 13; XXXIX. 2. **Rutland,** II. 14, 15; III. 9, 14, 15; V. 1, 2, 4, 8, 9, 11, 12, 13, 14, 15, 16; VI. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16; IX. 1, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16; X. 1, 2, 3, 4, 5, 6, 7, 9, 10, 12, 13, 14, 15. **Somersetshire,** VIII. 11; LVII. 11; LXVIII. 6, 7; LXIX. 7, 9, 10, 11, 12, 14, 15; LXX. 4, 8, 11, 12, 16; LXXI. 9; LXXVII. 4, 8; LXXIX. 1, 2, 6, 13, 14. **Staffordshire,** LXXII. 9. **Suffolk,** LII. 8, 11, 12; LIV. 1, 3, 6, 8, 9, 13, 14, 16; LV. 1, 2, 3, 4, 5, 6, 7, 9, 10, 11, 12, 13, 14, 15, 16; LVI. 1, 2, 3, 4, 6, 7, 8, 9, 10, 11, 12, 13, 14, 16; LVII. 1, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 16; LVIII. 2, 4, 7, 8, 10, 11, 12; LIX. 8, 10, 16; LXV. 1, 2, 3, 4; LXVI. 7, 11; LXVII. 9, 13, 14; LXVIII. 12; LXIX. 2, 5, 6, 7; LXXV. 2, 4, 5, 9; LXXVI. 5; LXXVII. 7, 15; LXXVIII. (3 and 7). **Warwickshire,** XXX. II. **Worcestershire,** V. 9; XIII. 1, 6; XVI. 7, 9, 10, 11; XVIII. 7, 8; XXIII. 1, 2, 3, 5, 6, 7, 9, 10, 11. 3*s. each*. (*E. Stanford, London Agent.*)

France. **Brette.**

Atlas des Bailliages ou Juridictions Assimilées ayant formé Unité Électorale en 1789. Dressé d'après les Actes de la Convocation conservés aux Archives Nationales. Par Armand Brette. Recueil de Documents relatifs à la Convocation des États Généraux en 1789. Paris: Imprimerie Nationale, 1904.

France. **Martel and Boissaye.**

Carte de l'Estérel dressée par M. E. A. Martel avec le concours de M. P. Boissaye. Scale 1 : 20,000 or 3·2 inches to 1 stat. mile. Paris: Touring Club de France, 1903. *Presented by M. E. A. Martel.*

Includes the French Reviera between Saint Raphael and Théoule, and the basin of the Cabre. The map is well drawn, and printed in colours. Relief is shown by contour-lines at intervals of 50 metres; rivers and streams in blue, forests in green, and the character of all roads and paths is indicated by various symbols. Tourists and others visiting the neighbourhood will doubtless find the map useful.

Liverpool Bay. **Belam and Ashton.**

Chart of Liverpool Bay. Scale 1 : 36,000 or 1000 yards to an inch. Surveyed by Commander Henry Belam, R.N., Marine Surveyor, and H. G. G. Ashton, F.R.G.S., Assistant Marine Surveyor, Mersey Docks and Harbour Board. Liverpool, 1903. *Presented by H. G. G. Ashton, Esq.*, F.R.G.S.

This is a new edition, revised and corrected up to date.

London. **Bartholomew.**

Plan of East London. By John Bartholomew, F.R.G.S. Scale 1 : 21,120 or 3 inches to a mile. New and revised edition. London: W. H. Smith & Son, 1904. *Price* 2*s., mounted on cloth. Presented by Messrs. John Bartholomew & Co.*

This is a new and revised edition extended to take in the eastern boundary of the County of London.

Mediterranean Region. **Fischer.**

Die Verbreitung des Ölbaumes im Mittelmeergebiet. Von Theobald Fischer. Scale 1 : 10,000,000 or 157·8 stat. miles to an inch. *Petermanns Geographische Mitteilungen*, Erganzungsheft No. 147. Gotha: Justus Perthes, 1904. *Presented by the Publisher.*

ASIA.

Indian Government Surveys. **Surveyor-General of India.**

Indian Atlas, 4 miles to an inch. Sheets: 1 N.E., parts of districts Larkhana and Hyderabad, and Khairpur Native State (Sind, Bombay Presidency), additions to 1901, 1903. 1 S.E., parts of districts Karachi, Larkhana, and Hyderabad, and Native State of Khairpur (Sind, Bombay Presidency), additions and corrections to 1901. 1*a* S.E. parts of districts Larkhana, Sukkur, and Upper Sind Frontier (Sind, Bombay Presidency), additions and corrections to 1901, 1903. 10 N.W., parts of districts Thar and Parkar, Hyderabad and Karachi, and Native State of Khairpur (Sind, Bombay Presidency), additions and corrections to 1901. 50 N.E., parts of districts Agra, Muttra, and Aligarh (United Provinces), Gurgaon (Punjab), Bharatpur and Alwar (Native States, Rajputana Agency), additions to 1894, 1901.

53 s.w., parts of Hoshangabad and Nimar (Central Provinces), Indore, Bhopal, Dewas, Dhar, and Gwalior (C.I. Agency), additions to 1903. 53 s.e., parts of Hoshangabad and Betul (Central Provinces), and the Native States of Bhopal and Holkar (C.I. Agency), additions and corrections to 1901. 130 n.e., parts of districts Sibsagar and Naga Hills, and of Naga Tribes (Assam), additions to 1903.—District Map of India, 64 miles to an inch. 2 Sheets, 1903.—The Central Provinces, 16 miles to an inch. 2 Sheets, additions to 1902.—Part of Chih-Li Province, China, 8 miles to an inch, 1903.—India and adjacent countries, 16 miles to an inch. Sheets (Provisional issue): 78, parts of Nepal, Sikkim, Tibet, Bhutan, Bengal, and Assam, 1903; 83, parts of Bengal, Assam, and Burma, 1903.—District Gujrat (Punjab), 4 miles to an inch, 1903.—District Gurgaon (Punjab), 4 miles to an inch, 1903.—District Wardha (Central Provinces), 4 miles to an inch, 1903.—Assam Survey, 1 mile to an inch. Sheets: 51, districts Darrang and Nowgong, Seasons 1886–88, 1890–91, 1897–98, 1903; 101 and 116 (Preliminary Edition), district Sibsagar, Seasons 1888–90 and 1898–99, 1903.—Bengal Survey, 1 mile to an inch. Sheets: 113, districts Muzaffarpur and Saran, Seasons 1892–95 and 1896–99, 1903; 135, districts Cuttack and Puri, Seasons 1887–88 and 1895–96, 1903; 165, district Cuttack, Seasons 1892–95, 1903; 192 (Preliminary Edition), districts Cuttack and Balasore, Seasons 1891–95, 1903; 220, district Balasore, Seasons 1892–94, 1903.—Bombay Survey, 1 mile to an inch. Sheets: 233, district Poona, Season 1873–74, corrections and addition to railway, December 1890, 1901; 265, districts Poona, Ahmednagar, and Sholapur, Season 1874–75, additions to railways to 1886, 1903.—Bombay and Madras Surveys, 1 mile to an inch. Sheets: 337 (Bombay Survey), 24 (Madras Survey), parts of districts Dharwar (Bombay), Shimoga, and Chitaldroog (Mysore, Madras), Seasons 1882–83 and 1893–94, corrected to July 1901, 1902.—Burma Survey, 1 mile to an inch. Sheets: 117 (New Series), districts Prome, Sandoway, and Thayetmyo, Seasons 1898–99 and 1900–1901, 1903; 118 (New Series), districts Prome and Sandoway, Seasons 1898–1901, 1903; 120 (New Series), district Henzada and Sandoway, Seasons 1899–1900, 1903; 155 (New Series), district Magwe, Seasons 1893–94 and 1901–1902, 1903; 160 (Second Edition) (178 Old Series), parts of districts Prome and Thayetmyo, Seasons 1882–83 and 1898–1900, 1903; 193 (Preliminary Edition, New Series), districts Shwebo and Mandalay, Seasons 1892–93 and 1899–1900, 1902; 287 (Third Edition) (306 Old Series), parts of Mandalay district and Northern and Southern Shan States, Seasons 1895–97, 1903; 309 (328 Old Series), districts Pegu and Hanthawaddy, Seasons 1880–82, corrected to 1897, 1903; 440, 441 (New Series), and 443, Southern Shan States, Season 1901–1902, 1903. Degree Sheet 53, parts of the Northern and Southern Shan States, 1903.—Central India and Rajputana Survey, 1 mile to an inch. Sheets: 71, parts of Jodhpur (Rajputana Agency), Seasons 1878–79, corrections to boundaries to 1902, 1903; 292, parts of Jaipur and Tonk (Rajputana Agency), Season 1866–67, additions and corrections to August, 1901, 1903; 320, parts of Gwalior (C.I. Agency) and Jaipur and Karauli (Rajputana Agency), Seasons 1864–66, corrections to 1900, 1903; 321, parts of Gwalior (C.I. Agency) and of Jaipur and Kotah (Rajputana Agency), Season 1865–66, additions to December, 1902, 1903; 322, parts of Gwalior (C.I. Agency) and Kotah (Rajputana Agency), Seasons 1865–67, additions to December, 1902, 1903; 324, parts of Gwalior (C.I. Agency), Kotah and Jhalawar (Rajputana Agency), Season 1870–71, addition of railway, May, 1899, 1903; 325, parts of Kotah, Tonk, Jhalawar (Rajputana Agency) and Gwalior (C.I. Agency), Season 1872–73, additions to roads and railways to May, 1899, 1903; 326, parts of Tonk, Kotah (Rajputana Agency), and Gwalior (C.I. Agency), Season 1872–73, addition to railway to December, 1902, 1903; 343, parts of Gwalior (C.I. Agency) and of Karauli and Dholpur (Rajputana Agency), Seasons 1863–65, additions to roads and railways to September, 1902, 1903; 346, parts of Gwalior (C.I. Agency), Season 1864–67, additions to December, 1902, 1903; 364, parts of Gwalior (C.I. Agency) and Dholpur (Rajputana Agency), Seasons 1863–65, additions to roads and railways to September, 1902, 1903; 365, 366, 367, 368, 370, 371, and 398, part of Gwalior (C.I. Agency), Seasons 1861–62, 1863–64, 1869–71, additions to roads and railways to September, 1902, 1903; 384 and 399 (Second Edition), part of Gwalior and Datia (C.I. Agency), Season 1862–63, additions to roads and railways to September, 1902, 1903.—Central Provinces Survey, 1 mile to an inch. Sheet 107, district Jubbulpore, Season 1901–1902, 1903.—Madras Survey, 1 mile to an inch. Sheets: 73, parts of districts Tumkur and Chitaldroog (Mysore), Seasons 1878–79, additions and corrections to September 1896, 1903; 80, part of district Mysore (Mysore), Season 1884–85, additions and corrections to March, 1902.—Punjab Survey, 1 mile to an inch. Sheet 85, district Mianwali, Seasons 1874–75 and 1878–79, additions and corrections to railways and boundary to 1901, 1903.—Punjab and North-West Frontier Province Surveys, 1 mile to an inch. Sheet 56 (Second Edition), district

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Russia, scale 1:2,000,000; 31, German Empire, scale 1:2,750,000; 35, Bohemia, Moravia, and Silesia, scale 1:1,000,000; 39, Great Britain and Ireland, scale 1:2,750,000.

World. **Stieler.**

Neue, neunte Lieferungs—Ausgabe von Stielers Hand-Atlas, 100 Karten in Kupferstich. 31 and 32 Lieferung. Gotha: Justus Perthes.

These two parts are in one cover, and contain the following maps: No. 36, general map of the British Islands, scale 1:3,700,000; Nos. 53 and 54, sheets 3 and 4 of a map of the Balkan Peninsula, scale 1:1,500,000; No. 56, North and Central Asia, scale 1:20,000,000. The maps of the British Islands and North and Central Asia are new, the others are revised editions.

CHARTS.

North Atlantic and Mediterranean. **Meteorological Office.**

Pilot Chart of the North Atlantic and Mediterranean for June, 1904. London: Meteorological Office. *Price 6d. each. Presented by the Meteorological Office, London.*

United States Charts. **United States Hydrographic Office.**

Pilot Charts of the North Atlantic Ocean for May, and of the North Pacific Ocean for June, 1904. U.S. Hydrographic Office, Washington, D.C. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

Argentine and Chili. **Streich.**

Album of thirty-three photographic reproductions of the country on the route of the Buenos Aires and Pacific Railway across the Andes from Buenos Aires to the Pacific, by Sr. Augusto Streich. *Presented by the Buenos Aires and Pacific Railway Company.*

(1) Government House and the Plaza de Mayo, Buenos Aires; (2) View in Palermo Park, Buenos Aires; (3) Transcontinental express of the Buenos Aires and Pacific Railway; (4) Restaurant car, Buenos Aires and Pacific Railway; (5) A typical "rancho" in the pampas; (6) Calle San Martin in summer, Mendoza; (7) Weighing and carting grapes in a Mendoza vineyard; (8) Transandine railway train, narrow gauge; (9) Tunnel on the Transandine railway; (10) Hotel and baths at Cacheuta; (11) Cerro de Plata, "Silver Range"; (12) Quebrada Seca, or the Dry Ravine; (13) River Mendoza; (14) El Paramillo de las Vacas; (15) The Tupungato peak; (16) "Los Penitentes;" (16) The Inca's bridge; (17–19) Hotel del Inca; (20) Valley of "Los Horcones;" (21) Aconcagua; (22) Valley of Las Cuevas; (23) Cerro de la Tolosa; (24) La Cumbre, the "Summit" of the pass and the frontier of both Republics, looking towards Argentina; (25) View on the Chilian side from the Summit pass; (26) Laguna del Inca; (27) The road at Juncallilo; (28) Valley of the river Aconcagua; (29) The present terminus of the Transandine railway on the Chilian side, Salto del Soldado: (30) The city of Valparaiso; (31) The public park of Santa Lucia, Santiago; (32) Congress House, Santiago; (33) The City of Concepcion, Chile.

Morocco. **Vacher.**

Twenty-one photographs of Morocco, taken by E. P. Vacher, Esq., in 1904. *Presented by E. P. Vacher, Esq.*

These photographs were taken by Mr. Vacher during a visit to the country in January last. Eleven of them are of Morocco city, five of Mogodor, and the remainder of scenes *en route*. The following are the titles:—

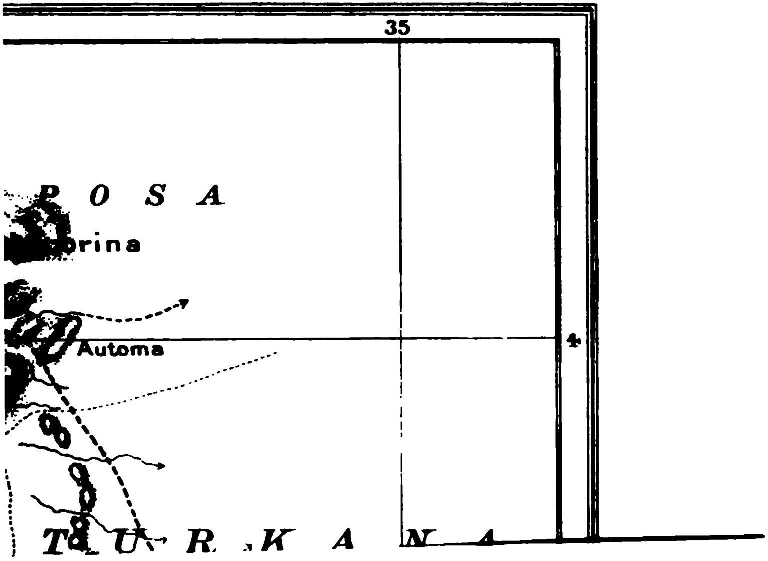
(1) Morocco city; (2) The sultan's garden, Morocco city; (3) Market place, Morocco city; (4 and 5) Bazaar scene, Morocco city; (6) Portion of the wall which surrounds Morocco city; (7) Tower of a mosque, Morocco city; (8) Fountain and mosque tower, Morocco city; (9) Slave market, Morocco city; (10) Slaves on sale in slave market, Morocco city; (11) Gateway, dividing two parade grounds near sultan's palace, Morocco city; (12 and 13) Gateway in Mogador; (14) Main street, Mogador; (15) Two of the escort at Palm Tree House, Mogador; (16) Entrance to Palm Tree House; (17 and 18) The market-place, Mazagan; (19) Mid-day halt; (20) Camp in dismantled castle near Ileta; (21) Mr. Vacher's quarters for one night at Sheshasua.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

BRITISH EAST AFRICA & UGANDA.

POWELL-COTTON.

THE GEOGRAPHICAL JOURNAL, 1904.



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Geographical Journal.

No. 2. AUGUST, 1904. Vol. XXIV.

THE GERMAN ANTARCTIC EXPEDITION.*

By Dr. ERICH VON DRYGALSKI.

The German South Polar Expedition, on which I have now to address you, has been absent altogether twenty-eight months, of which fourteen months were passed in the south polar ice, ten months with our operations in the South Atlantic and South Indian oceans, and four months with our work and residence in the islands of the Indian and Atlantic oceans and at the Cape. Our labours were at once begun on reaching the equator, and thereby were carried out, not only our own plans, but also the expressed wishes of all the scientific circles in Germany. We had not only to make ourselves familiar under easier conditions with our search appliances, with the *Gauss* and its arrangements, but, above all, to face from the first certain problems which awaited our subsequent operations in the south polar region. When I venture to recall the fact that in the glowing heat of the tropics, at temperatures of 30° C. at the surface, icy cold water already prevails at depths of 800 to 900 metres—a phenomenon referred to in theory to south polar influences—it will not appear unreasonable to suppose that the study of these conditions must have some interest for an expedition bound for the Antarctic Region, their presumable source, not to mention the question of the fauna living in these different marine waters. And so with other matters, as, for instance, the question of terrestrial magnetism.

But above all we had to make ourselves acquainted with the ship and her equipment. Amongst the good points of the *Gauss* was her thorough seaworthiness, which she had maintained despite her rounded forms, and later gave proof of under the exceptionally heavy stress of the "rolling forties." Amongst her drawbacks was a certain lack of speed, which made the voyage to Cape Town longer than I had calculated. For this, however, the ship was not to blame, since she had been built stout enough to resist the ice, and exceptionally broad in order to lie steadily in heavy seas, and was, moreover, heavily laden and equipped with large deck-structures, which presented unwelcome surfaces to the play of the wind, and made the steering more difficult. With all this the *Gauss* could scarcely be a swift sailer; nor was she built for this purpose. The estimated speed of 7 knots was maintained only in still water or in calms amid the doldrums; but to advance at this speed on the constantly rolling surface of the ocean there were needed strong gales. As in the tropics we had remarkably light trade winds and frequent calms, we made slow headway. The time was, however, turned to good account for our operations on the ocean. Still, our arrival at the Cape was thereby delayed quite a month, although this circumstance turned out to be a matter of indifference, or rather actually advantageous for our later progress southwards.

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* Read at the Royal Geographical Society, April 25, 1904. Map, p. 248.

In Cape Town, towards the end of November and beginning of December, 1901, we again compared our instruments with those of a fixed observatory, the excellent observatory of Cape Colony, just as, shortly before our arrival, had been done by the British Antarctic Expedition on board the *Discovery*. We also completed our vessel's equipment in some few details, and enjoyed the hearty welcome accorded to us by all circles in Cape Colony.

It would be scarcely possible to imagine a sharper contrast than that which we experienced on our departure from Cape Town on December 7, 1901. In five days, after crossing the warm Cape Agulhas stream, we plunged into the cold currents which are already connected with the frozen ocean, and in a few hours passed from the smooth waters of the harbour and its neighbourhood into the ceaselessly storm-tossed sea surrounding the antarctic circle.

Our next undertaking was the study of this sea, where prevail the everlasting west winds which encircle the globe between the extremities of the continents and the south polar ice—a sea dreaded for its mighty billows, for its constantly overcast skies and fierce gales. Round our vessel hovered the various species of albatrosses, Cape pigeons, blue petrels, œstrellata, majaquæus, and other southern storm birds, which thus presented a strong contrast to the lifeless calms of the tropical seas. This austral ocean is for the most part traversed only along its northern edge, although the shortest routes between Africa, South America, and Australia lie more to the south. Its navigation is so far easy enough, having to do almost exclusively with westerly winds alone, hence is nearly altogether confined to the course from west to east, the opposite direction against the dominant winds and currents presenting great obstacles even to powerful steamers, while there is, as a rule, no question of more northerly or southerly routes.

In this sea we successfully carried out a series of soundings and investigations between Cape Town and Kerguelen, and further on as far as the fringe of ice. Amongst the results, I lay stress on the demonstration of a trough over 4500 metres deep, running between the Crozet islands and Kerguelen, and connecting the abysses of the Indian ocean with a deep ravine on the outer edge of the austral glacial sea.

It was by no means easy to operate in this region, where the deck was almost constantly swept by huge waves. Most difficult, perhaps, was it to continue the terrestrial magnetic work, as for this purpose a fixed position of the freely balanced magnetic needle is needed to read off the scale. This is naturally a difficult task while the ship is heavily rolling and pitching and the needle answering with still more violent vibrations. Nevertheless here also we managed, through the energetic labours of Dr. Bidlingmaier, to record complete and serviceable observations along a somewhat extensive curve or loop, which in the form of a horizontal 8 traverses the South Indian ocean and the glacial sea.

SURFACE OF INLAND ICE, SHOWING UNDULATION OF LAND SURFACE.

During these researches between Cape Town and the fringe of ice our outward voyage was broken by three visits, first to Possession island of the Crozet group, and then to Kerguelen and then to Heard island of the Macdonald group. On Kerguelen we tarried one month, and a day each on the other two islands.

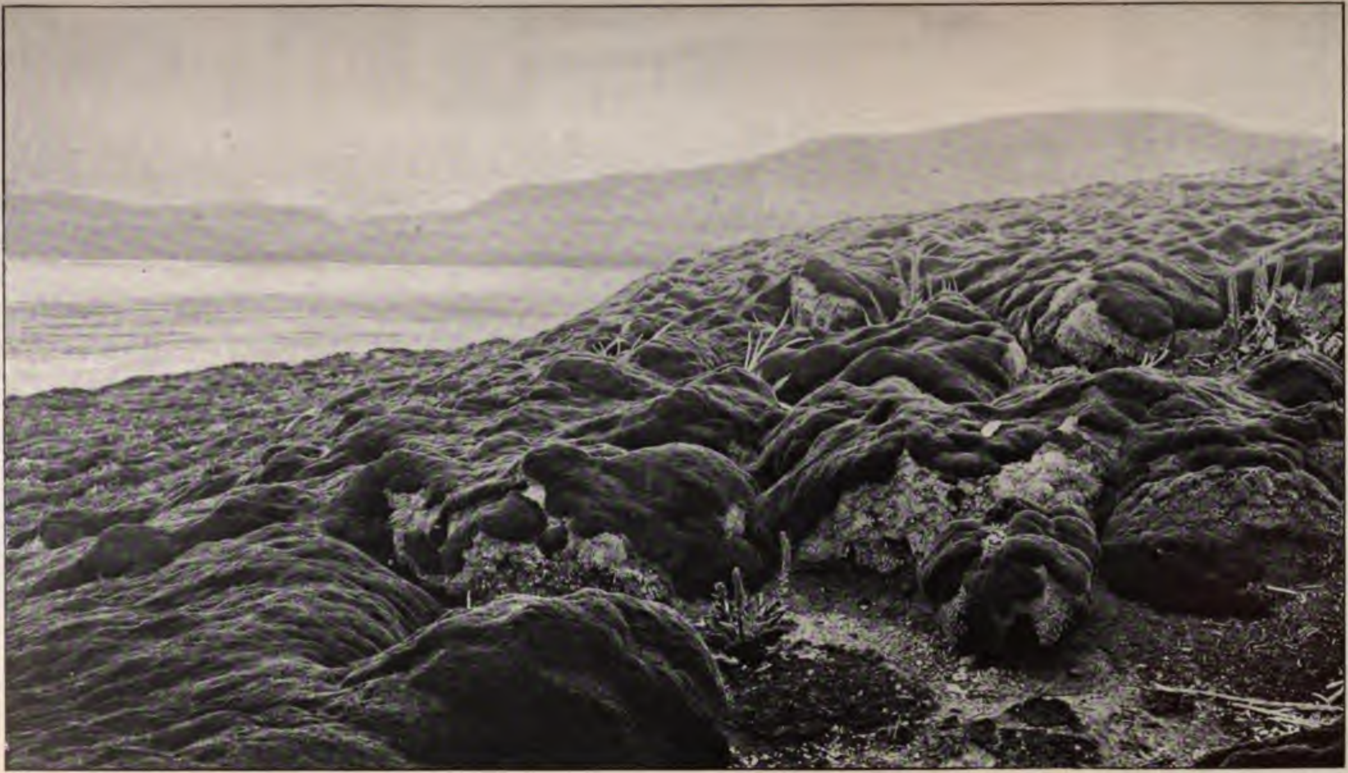
All three groups are uninhabited. Lying in the zone of the perennial west winds, they are continually buffeted by storms accompanied by snow and rain; hence with their cold damp climate they offer no attractive places for settlement. At Kerguelen we had snowy weather in January, that is, the midsummer of those parts, and that in a latitude corresponding in the northern hemisphere to that of South Germany. Throughout the year the temperature is equable, and oscillates relatively little round the freezing-point. Here trees do not thrive. The land is rocky, or in the depressions swampy, like a sponge supersaturated by the frequent downpours. All three groups are igneous, partly of still quite recent volcanic origin, as was plainly evident. On Kerguelen and Heard the glacier development is considerable, and was more so in former times.

On these insular groups the animal and plant world retains its full primeval charm. In Kerguelen alone it presented a marked change, for here some thirty years ago the *Challenger* Expedition let loose a few rabbits, which have increased to a remarkable extent, and come hopping round strangers landing on the coast. They have seriously reduced the indigenous flora, having especially almost completely extirpated the edible Kerguelen cabbage, which now grows only on isolated islands and inaccessible cliffs which the rabbits do not frequent.

In Kerguelen we stayed a month, in order there to establish a branch station to make terrestrial magnetic and meteorological observations while we remained in the Antarctic waters, and also in order to ship fresh supplies.

Here the steamer *Tanglin* had gone ahead with Herr Enzensperger, Dr. Luyken, and the sailor Wienke. When we met them on January 2, 1902, in Observatory bay, we found everything already almost completely installed, and the station beginning its operations. The members were all in the best of health.

But when, on the return voyage, we reached Cape Town on June 9, 1903, we learnt that Herr Enzensperger had died, and that Dr. Werth was slowly recovering from a severe illness in Sydney. A frightful calamity had overtaken the station, a calamity appalling in the solitude, in the impossibility even to foresee and prepare for it, hence especially terrible in the relentless fury with which it fell upon its victims. About six months after our departure, and nearly eight months after the return of the steamer *Tanglin* from Kerguelen, Dr. Werth, who had sailed with the *Gauss*, fell ill of the Chinese malady beriberi, from which the crew of the *Tanglin* had suffered, although he had not again come in contact with them, and two months later Herr Enzensperger was also attacked. His strong constitution had struggled vigorously against the terrible disease, while all the time fulfilling his duties with unwearied loyalty to the last. He now rests far from his South German home on the very spot to which were devoted his last trusty labours, his hopes, and his great projects. With the profound



AZORELLA FORMATION ON KERGUELEN ISLAND.

grief for his death is mingled a sense of wonder at what was withal achieved in Kerguelen, and will remain the fairest monument of our departed associate.

On January 31, 1902, we left Kerguelen, and on February 3 Heard island, after the already-mentioned short visit. Now the great unknown lay before us, and here we had to seek out the right course, which, in the almost complete lack of previous experiences, was practically a question of pure luck.

I may here mention how the *division of labour* was carried out among the several nations which were at the time engaged with the exploration of the Antarctic region.

INLAND ICE AND MORAINE AROUND GAUSSBERG.

England aspired to build on the foundations which had been laid by James Clark Ross in the years 1841 and 1842, and thus complete our knowledge of the Ross sea, that great portal of the south polar domain which Ross had discovered and navigated beyond 78° S. We already know with what brilliant success the English Expedition under Captain Scott has fulfilled its mission; it is a pleasure to me to be able here to congratulate the English people and the Royal Geographical Society on this great achievement, and to express my satisfaction that the expedition in the *Discovery* has been so fortunate as to get out of the ice and to make its return journey successfully.

To the *Swedish Expedition*, under the guiding hand of Otto Nordenskiöld, was assigned the insular region south-east of America. The

Scottish Expedition, under W. M. Bruce, which set out in 1902, that is, a year later, undertook the exploration of the Weddell sea, in which, in 1823, Captain Weddell had penetrated with two ships beyond 74° S., whereas his successors, amongst them Dumont d'Urville, Wilkes, and J. C. Ross, as well as Bruce himself, according to the latest news, were all prevented by the ice from getting so far south. The Argentine Republic has established a meteorological-magnetic station of the first order in Staten island.

The *German Expedition* had at the time the choice between the regions bordering on the Indian ocean south of Kerguelen and the Weddell sea, which forms a southern prolongation of the Atlantic ocean. Both regions were supported by weighty votes, and if I decided for the first, and accordingly chose the Kerguelen route, it was on geographical grounds which to me seemed conclusive. For south of Kerguelen, between 60° and 100° E. of Greenwich, there lay before us an Antarctic region where hitherto no serious advance had been attempted, and where were consequently concealed many debatable problems. Here the voyages of Cook, Bellingshausen, Biscoe, and Kemp failed to reach 63° S.; Moore got a little beyond 64° S.; and the *Challenger* alone succeeded in passing the Antarctic circle, but then, to avoid being closed in, returned without sighting land.

Now, the relatively low degrees of latitude here reached might, as I said to myself, have been due to the fact that progress in this quarter was specially difficult, owing possibly to some unknown seaboard projecting far to the north and moreover encompassed by a broad zone of pack-ice. It might, however, be also due to the pioneer ships, since vessels under sail or not properly equipped for glacial navigation had alone made those first serious but premature essays. In point of fact, nothing was yet known about the trend of the coast; land had not yet been anywhere sighted in that direction.

The complete uncertainty prevailing about that region between 60° and 100° E. is best shown by the two diametrically opposite views still current regarding its conformation. Thus one of these views assumed a seaboard which about the latitude of the polar circle forms a connection between the foreland sighted by the American Wilkes in the east, that is to say, Knox Land, and the Kemp's and Enderby lands lying more to the west.

The other view, which is substantially that advocated by Privy Councillor Von Neumayer, questions the validity of Wilkes's arguments for the existence of a coast between Knox Land and Kemp's Land; on the contrary, here he conjectures a sea stretching away to the south, and kept open by a stream which sets from Kerguelen southwards, and perhaps here crosses high southern latitudes and merges in the Weddell sea.

When I selected the Kerguelen route, I was of course aware of these views. Hence, like the *Fram* expedition in the north, I calculated both on the possibility of being caught up by a drift and thus carried over high southern latitudes to the Weddell sea, as well as on the óther possibility of soon striking land. From the scientific standpoint, it was naturally a matter of indifference whatever the issue might be. In the first case, a drift like that of the Fram perhaps tempted us with a dazzling superficial result and recognition on the part of those who measure the value of a polar expedition only by the degrees of latitude. In the second case—the discovery of land—we were attracted by an intense desire to penetrate into the physics of the Antarctic region in a way that could not be attained by a drift.

GAUSSBERG FROM THE NORTH-EAST.

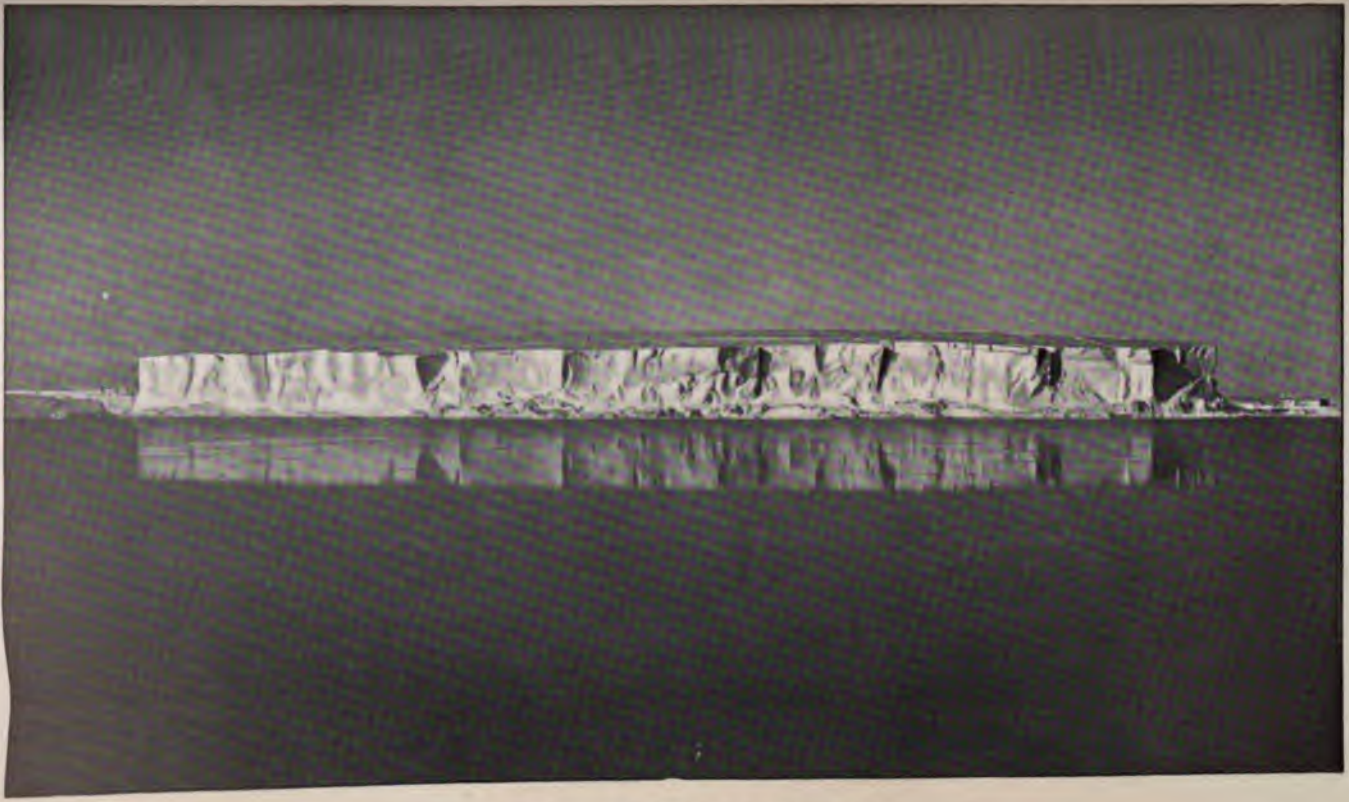
As you know, the decision resulted in favour of the latter view. We found a seaboard trending east and west just a little south of the Antarctic circle, and consequently forming a bar to further progress southwards. For a portion of the unknown space between Knox Land and Kemp's Land—a stretch of over 600 miles—a land connection is now definitely established. We should have gladly obtained direct evidence for the remaining section also. But for this time was wanting, and my request for permission again to sail from Cape Town southwards and thus continue our investigations failed to meet with the approval of the Government. But how far our observations may by indirect inference shed further light on the trend of the coast farther west I cannot decide until our worked-up material is available.

The navigation in the section of the glacial sea visited by us may be described in a few words. Our course was determined by the land projecting far north up to the latitude of the Antarctic circle. Before this land are yearly formed in a fixed position vast marine ice-fields, which even in summer do not thaw, the summer heat being insufficient for the purpose. But every year some of the ice-fields break away, and then drift with the currents in vast irregular processions away to the north. Hence the prevailing currents have a trend from south to north, and not from north to south as is supposed. Now, it is extremely difficult, almost impossible, to attempt to sail through this drift-ice parallel with the coast, that is, in an east-to-west direction. In doing so one gets blocked again and again, is caught up with the ice by the currents, and is borne northwards away to the open seas. But it is quite possible to sail between two such drifts from north to south or from south to north, and of such routes there are many. Their position depends on the winds; but one may always calculate on finding such routes, and thus reach the southern seaboard.

After two fruitless attempts, which brought us nothing but evidence of the non-existence of Termination Land, we discovered one of these routes, and from February 18, 1902, pushed southwards with relatively little trouble. Then came obstructions; the icebergs increased, and these together with the floes threatened to block the way. Still, these difficulties were overcome, and, strange to say, the swell soon again came from the south, and presently we had before us the wide open surface where they took their rise. Here was a vast free expanse, apparently a boundless open waterway leading southwards; we were elated with the hope that we had at last discovered a free route to high southern latitudes, perhaps a course west of and analogous to the Ross sea, a second hitherto unknown portal to the polar regions. Then, on February 19, the plummet unexpectedly touched ground in a depth of 240 metres, after we had shortly before recorded soundings of 3000 metres and upwards. A snowstorm was blowing, and we could see nothing. Still, the sea was shallow; the wind betrayed symptoms of a "föhn," hence must be coming from *terra firma*, while the *plankton* also indicated proximity to land. There could no longer be any doubt that we were off some coast, though we could not see where.

All was excitement the next day, when we drove in a fierce snowstorm between icebergs, though otherwise in the open sea. During the night on February 21 the weather improved, and when the short night yielded to day there lay the land—a new land—before our eyes.

Whatever feelings may have agitated us at this sight—whether grief that a stop was so soon put to our ambition to advance farther south, or joy at the actual result, the happy solution of a great geographical question—one thing is certain, that for the moment all other



TYPICAL ANTARCTIC ICEBERG.

feelings gave way before the imposing view of land. There it lay in its quiet solitary grandeur, never before beheld, never before set foot on. All was ice-clad; still, that it was land was shown beyond all doubt by the very forms affected by the ice. For, looking towards the coast, we could see the uniform surfaces which sloped down from the south in broad smooth undulations, branching off and developing glaciers, such as are conditioned by the forms of a firm substratum. The coast itself was a high vertical wall of ice, too steep to be approached in whatever direction we turned our eyes, only somewhat diversified high up and with an approximate east-to-west trend—in fact, such another ice-cliff as in his time confronted Ross on the southern margin of his Ross sea.

CAMP ON THE ICE.

A landing on this icy barrier was out of the question. Hence we resumed such operations as, in the absence of ice-free tracts, might lead to some conclusions regarding the substratum of the ice-cap—that is, the character of the land itself. We accordingly took soundings, fished with the drag-net, and made magnetic observations. Then we continued our course in the direction of the west, since from the spot where we had struck land, and from what we had already seen of its nature, we had drawn a sufficiently accurate inference regarding the section of Wilkes Land which lay east of us. Hence we had now to follow the coast westwards in the direction of Kemp's Land, in order to see in what way was filled in the unknown gap between Knox and Kemp's Lands.

In the year 1902 our voyage could not be continued much longer, and our freedom of action was already reckoned only by the hour. By midday of February 21 we were already fain to take a northerly bend, as dense chains of icebergs barred our way westwards. These we skirted, ever on the look-out for a break through which to pierce them. Small openings also presented themselves, but caution was incumbent on us, for the icebergs gave the impression of being of great age, as if they had long been in this position, and as if, as far as one could foresee, they might still remain for an indefinite time in the same position together with the vessel penetrating into them. At last was seen a wider gap, presenting a waterway to the west, and I did not hesitate to utilize it. We therefore resumed our westerly course between an old group of icebergs, which were apparently still fixed on the south, and a troop of icebergs, possibly already floating away on the north side.

Meanwhile it was nightfall, and easterly winds had sprung up, which rapidly increased in strength. With them we forged swiftly ahead, and presently found ourselves completely surrounded by the ice, and even at some distance ahead everything seemed again to close in. The darkness was unfavourable for pursuing this course, for we could no longer see whither we were tending. The wind also was growing to a blizzard; everything round about was driving rapidly ahead, and we unwillingly in its company. Then I decided to keep to the one safe thing here available, that is, the open sea off the land where we had been in the morning, in order thus still to preserve our freedom of action. I accordingly gave the command to return southeastwards in the direction of this sea.

It could no longer be reached. With the still waxing fierce snowstorm the ice drove down upon us from the east. Confused groups of floes rush swiftly through snow and fog, through which the eye can no longer clearly penetrate, as they seem now grown to hills and continuous ridges, and amongst them real icebergs which the ship had to avoid. Thus was the course constantly changed, with frequent collisions and pressure from the floes, and then at last, towards four o'clock in the morning of February 22, 1902, a long protracted grinding sound, which gradually ceased; the storm continued, but we lay fast and presently almost at rest—*the rest of a twelvemonth.*

On expeditions like ours, crises such as we had just experienced seldom present themselves at once to the mind quite clearly with all their far-reaching consequences, and if they do, it is still but for a moment. Every instant has its appointed task demanding immediate performance, and thus diverting attention from thoughts about the future. But if we later look back and weigh the *pros* and *cons* of the actual results, I must now say with full conviction that the final issue, brought about by the fierce snowstorm during the night of February 22, 1902, was on the whole fortunate.

Here we now lay on the spot which was to be our winter station in a shoal from 300 to 400 metres deep, which was, moreover, encompassed by many other even shallower banks. These banks are traversed by the huge icebergs which break loose from the edge of the inland ice, not floating away, but stranding on them, and thus remaining long in the same position. These iceberg shoals also so firmly arrest the floes, which are driven against them by the prevailing east winds, that operations may be conducted on them as on *terra firma*. On the floes surrounding us we were able to carry out even the most delicate observations without disturbances of the level, and of such splendid sites for stations there are many, as the configuration of the coast remains the same for long stretches. The only drawback is that they may become even much more stable than one thinks or wishes, since a break-up cannot be depended upon in every summer season. But away to the north of these iceberg shoals, where the deep sea begins, such sites for stations are no longer met, for there even in winter the ice is perpetually moving and drifting. Had we succeeded in sailing round the north end of the shoal on the night when we stuck fast, as we did the next year, we should have been caught up by the floating ice and the northerly currents prevailing in it, and in about two months

THE "GAUSS" BURIED IN SNOW, FROM WEST SIDE.

should have again found ourselves in the open sea. But in that case there would have been no possibility of getting back to found a station.

From this it follows that it would have been useless for us to have attempted to press forward through the ice at an earlier time of year. For even supposing that in this we had succeeded as well as in February, and supposing, further, that we might not have been held fast so early as in February, we should still have had again to trust to the driving floes on the edge of the still waters in order to make headway, and therein there was only a slow drift and a still slower course northwards. If there was any at all, we should have seen but little more of the coast than we did the following year, and at the same time must have left our good winter station quite a moot question, and might possibly not have been able to winter at all.

As it happened, we established our winter station on these floes. They were 5 to 6 metres thick, large and angular, with raised edges, and showed by their forms that they had only been for a short period on the move during the year. On them we were able to erect firm observations; but not all of them were equally suited for this purpose, for during the course of the winter they became so heavily laden with snow that they sank below the surface, so that the appliances installed on them had to be removed. In due course we learnt to recognize that this snowy element was the chief factor in the formation and structure of the floe-ice, while the snowstorms were the mightiest force dominant in the south polar region.

At times announced by clouds from the east, which with small beginnings rapidly overcast the whole sky; at times also suddenly filling the air with powdered snow, and mostly accompanied by an increase of temperature; always with abundant snow, whether it falls simultaneously or is only driven forward by them—thus begin these blizzards, which rapidly acquire a terrific impetus.

Try ever so often, it is quite useless to contend with them. At but a few metres' distance nothing could be seen from the ship, so that on one occasion a sailor enveloped in a snowstorm in the immediate vicinity of the ship was lost for hours, until the whole crew lashed together went in search and fortunately found him. On a sleighing excursion which I had headed, I suddenly lost sight of the sleigh, although it was close behind me. When I stopped, the dogs ran up. With much toil we gained the tent, shoved the sleigh in to support and steady it, and then lay a day and a night, and yet another day and night, without the possibility of leaving the tent, eight of us in the narrowest space, where for forty-eight hours all natural functions had to be performed. Outside the storm raged and rattled against our tent, which from within we propped up and held fast. Then it began slowly to bury itself in the snow, and through every rift the snowy blasts made their way in and over our sleeping-sacks, so that when, after long waiting, the weather grew better, it took us hours of hard work to dig out the tent.

Almost worse were the effects of the blizzards on the ship. Once we had all to turn out to rescue the dogs, which were chained up and getting smothered in the snow, as their doleful howlings told us just in time. The gusts swept over the observatories, so that the floes sank under the tremendous impact. Then the observatories got flooded with water, which, with the steady subsidence of the floes, penetrated from below; nor was it always possible to save the instruments, so sudden were the squalls. The ship itself felt the shocks, and under the fearful strain constantly heaved over. In the first of those gales, before we were prepared for them, doors and windows and all the hatches were shattered, and everything inside was as if buried in a huge grave. It cost us great efforts to recover ourselves and again to clear the vessel, an operation which had to be repeated again and again. For such storms were far from rare. With but short intervals, they raged throughout nearly the whole of May and August. In June and July it was a little better, though many such storms visited us in April and again in September. Even in midsummer they did not spare us, and one of the fiercest burst upon us in January. Their worst feature was their duration. For although in summer they lasted only a day or two, in winter we might have to endure them for from three to five days,

WEDDELL SEAL.

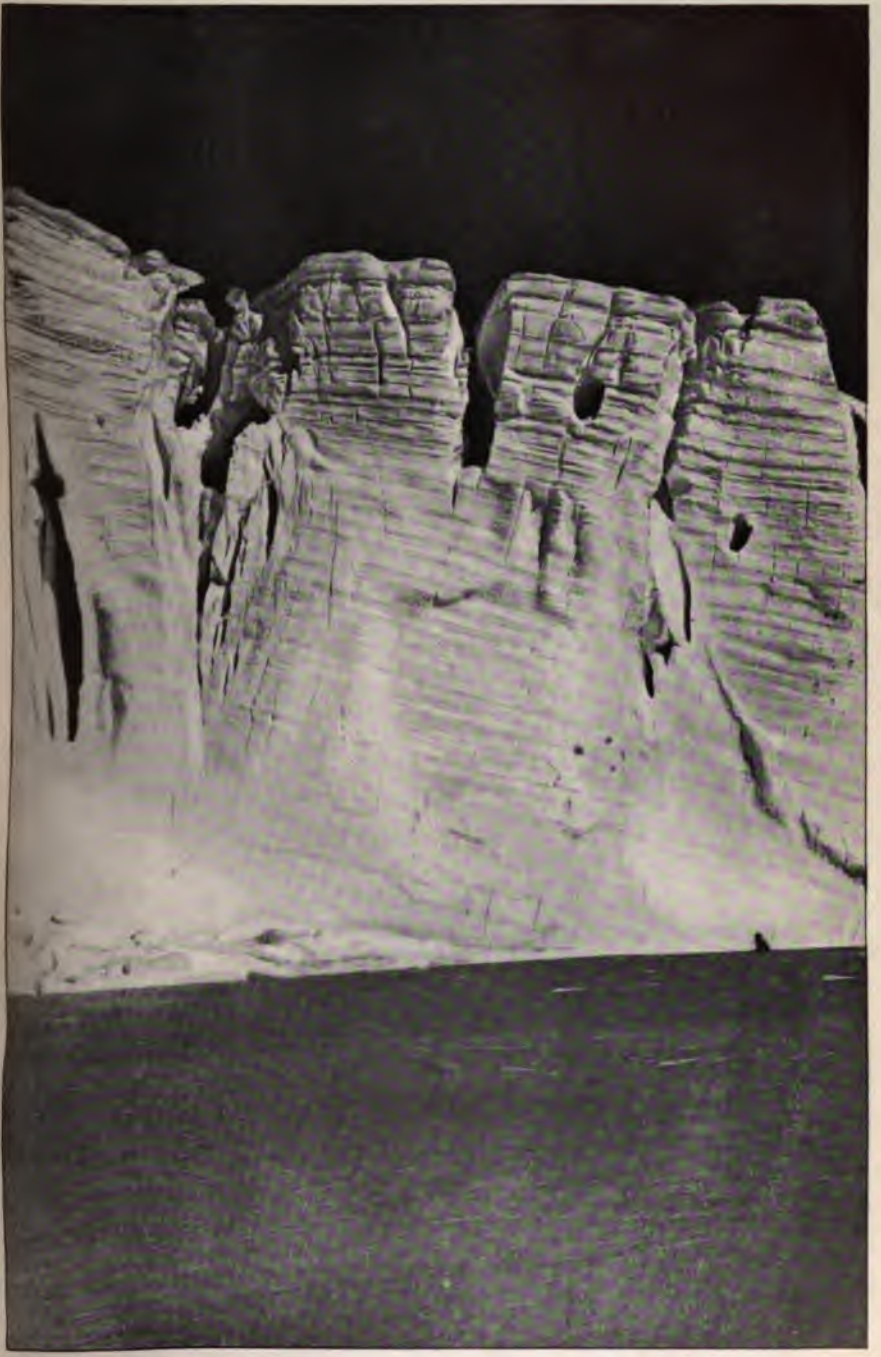
seeking in the ship or the tent such shelter as they could afford. Our daily visits to the observatories were of course uninterrupted, being made by means of cables, which extended to them from the ship and enabled us to pass to and fro.

During the installation of the station in March, 1902, we started our sleighing excursions, and kept them up till far into the winter, that is, till the middle of May, and then resumed them in September, continuing them well into December. That we selected the worst seasons of the year for these sleighing trips, suspending them in midsummer, was conditioned by the position of our station. We were not moored to the land, where one might remain as long as he liked, but closed in by floe-ice, which we might expect and hope would break up in the summer. But then the ship would have necessarily to leave its station without our being able to conjecture when and whither, as, in fact, it turned out at last. Besides this, in midsummer, all travelling on the marine icefields was extremely difficult. Through the action of the solar rays, combined with that of the marine waters surging up from below, the floes became so thoroughly decomposed that even in December one sank at every step up to the waist and even higher, so that whatever progress could be made at that time with laden sleighs over the ice stood in no kind of relation to the toil and labour spent on it. In this respect the relations were essentially different on the land ice, where is lacking the strongly decomposing action of the marine water intruding from below.

And, in fact, the ice looked as if it might break up at an early date. Throughout the whole winter we had noticed the ice constantly floating and drifting at a distance of from 6 to 10 miles to the north and within less than 4 miles east of the station. On September 16, 1902, the day before our starting on a month's sleighing excursion, the great pack which we had observed nearly 4 miles to the east began suddenly and without any very perceptible reason to drift away to the north, and on the same day 600 metres to the west of the ship a fissure opened where the very pack in which we lay began to break up. Under these circumstances, we could no longer have any great confidence in the stability of the position then occupied by us.

The difficulties of the sleighing excursions in the colder seasons of the year were not light. Specially hard work was the long observation of the instruments while taking measuring records on the inland ice, since here we had still to face both a temperature of from 20° to 30° C. below freezing-point and persistent high winds. Easier was the forward motion with the sleighs, although even here great physical efforts were needed.

The sleighing journeys, which occupied us altogether five months, had for their objective the seaboard, the ice-free *Gaussberg*, which we there discovered, and long scientific operations in its vicinity. It would



STRATIFICATION OF THE INLAND ICE.

doubtless have been possible to push from the *Gaussberg* over the inland ice southwards. In any case, it was easier than the long stretch of 46 miles from our winter station to the *Gaussberg*. But little was to be expected from such a journey. It was improbable, if not hopeless to expect, that we should again come upon ice-free land in the direction of the south. This we could infer, not only from the extensive prospects commanded by the *Gaussberg* and by the captive balloon, but also from the whole aspect of the inland ice, which suggested the notion of boundless space and monotony. The same conclusion was above all indicated by the winds, which blew from the inland ice, and by their Föhn properties pointed at a far-reaching, uniformly ice-capped hinterland.

MORAINE ON THE EAST SIDE OF GAUSSBERG.

Thus we had nothing to expect from the interior beyond a long journey over uniform undulating ice, such as we had already seen on the coast, without, however, being able to arrange for serious observations.

During our sleighing trips records were taken of the phenomena of motion presented by the inland ice; the characters of a real littoral fauna in the south polar region were compared with those in the *Gauss* found in the smooth waters; so also the climatic phenomena immediately on the coast with those further out on the open sea. Efforts were made to ascertain whether the oscillations of the terrestrial magnetic forces close to *terra firma* differed from those at depths of over 400 metres, as they had been for the first time studied from this point of view at our winter station. Stones were collected; lichens and mosses were also found; the nesting-places discovered of one of the two species of stormy petrels in the Austral glacial sea; perhaps, also, information was obtained of a south polar insect. In a word, many interesting facts were brought to light, amply rewarding the great expenditure of five months' time and efforts on these sleighing excursions.

With our daily work and occupations about the station, the winter passed quickly enough; the early spring even quicker with its sleighing excursions. Then came summer with its long days, its abundant light, and occasionally also a little welcome warmth. On ten days of the year the atmospheric temperature rose for a short time above the freezing-point. But where the sun shone it was even oppressively warm; eyes and skin suffered from the fulness of the light, and required continuous protection. Those who neglected such shelter had to seek medical treatment for snow-blindness or for blisters on the face, and especially on the lips.

December was the warmest month. In January it was already colder, and the pools on the glacial surfaces were again frozen over. Thus January was the month of expectation for our release, which most of us already began to despair of, owing to the steady falling off of all indications of summer. Now, also, we were busy with the new plans for the contingency of our release being deferred. Amongst these preparations was a rough rubble track which we had laid down for over a mile across the ice to the position of the *Gauss* in a line with her bow, the object being to hasten the melting of the ice by the dark rubble and its greater absorption of heat in the sun. Other expedients were blasting operations (which, however, had no great results, thanks to the immense thickness of the ice), and also the release of the *Gauss* from its winter quarters by means of ice saws 6 metres long.

All these efforts, however, could but confirm the impression that everything we might contribute to our release was as nothing to what had really to be done. If we were to be liberated, nature herself would have to re-open the gates which she had closed. The rubble track alone had actually melted to a broad waterway, although even this was at most but 2 metres deep, whereas the ice to be broken up had an average thickness of from 5 to 6 metres, and our waterway was again frozen over in January.

But suddenly, on January 30, 1903, the whole situation was materially changed, for the icebergs which had closely encompassed us now began to drift away northwards. Three days later they were followed by the pack-ice in which we lay, without, however, breaking up, and as it was 2½ miles long and over a mile wide, it was unable to get through the barrier of still immovable icebergs. With it we drifted to and fro round about the place where we had wintered. Then suddenly, on February 8, came our deliverance. On the morning of that day we noticed a movement in the sea amid the floe-ice; this movement increased during the day, and here the ice suddenly broke in two at 3.15 in the afternoon. The cleavage took place along the line where we had laid down the rough track, and on which the ice had thus been weakened. Now all was free; the boilers had for days been heated with penguins; all articles lying about on the ice were rapidly got on board; after a three hours' struggle the fissures were wide enough for the *Gauss*, and about 7 o'clock in the evening we were able, with three hearty cheers, to leave the site of our winter quarters.

Meanwhile an east wind had sprung up, like that which a year before had held us fast to the same place, and, as on that occasion, in the course of the evening it developed to a snowstorm, which again immediately closed the newly formed rifts where we had just found deliverance.

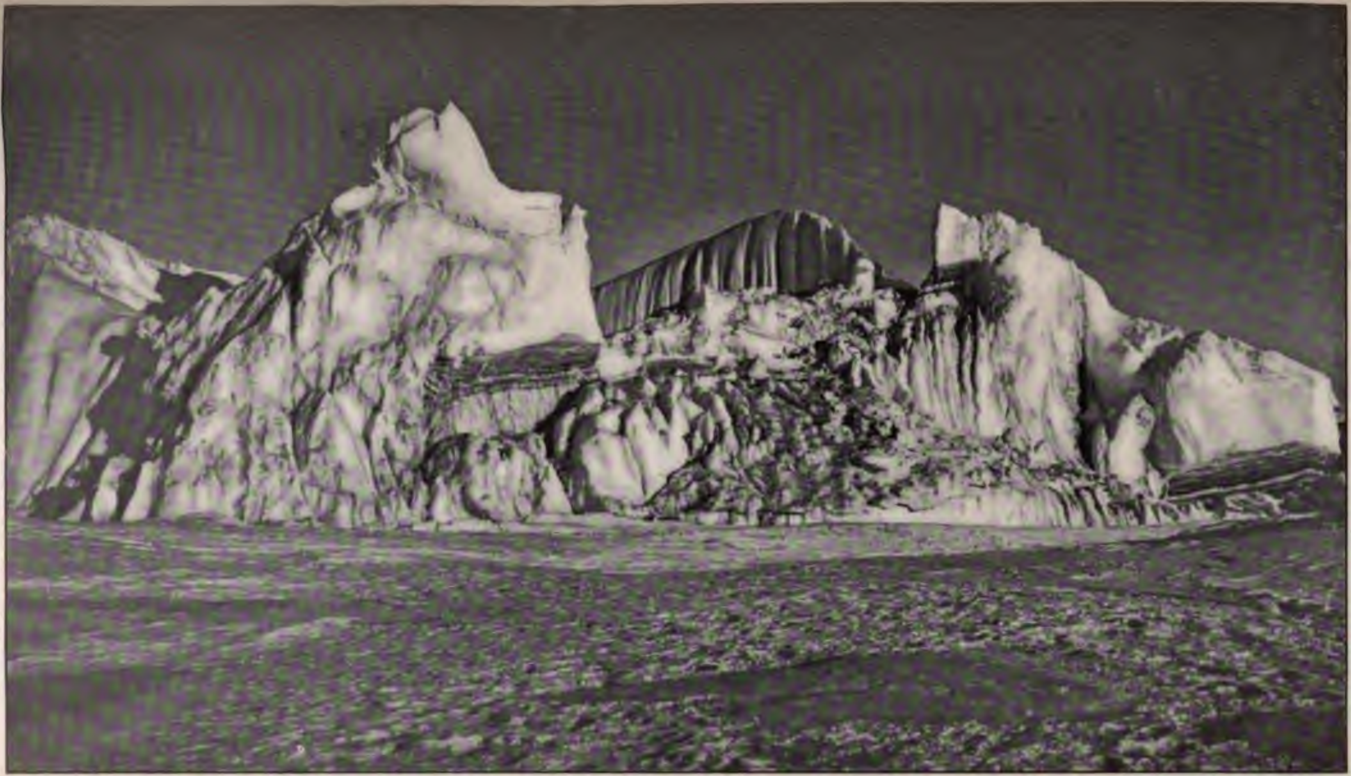
On the further vicissitudes of the expedition a few words will suffice. For exactly two months, to April 8, 1903, our struggle with the ice was maintained. My plan was to continue our westerly course as long as possible in the later season of the year, and then seek out a new winter station, in order to pass a second winter in another locality, and in the following spring extend our route still further along the coast. Now, however, it fell out as I had anticipated from the character of the navigation. North of the iceberg shoals in deep water we were again and again closed in by the ice drifting in the direction from south to north, and thus carried northwards to the open sea, where we for the first time again found ourselves on March 16, 1903. Although the season was already far advanced, I still wanted to make a new attempt. We therefore directed our course at first along the outer edge of the floe-ice, and then seized the first oppportunity to again push south, in order, if possible, again to reach the coast, and there pass the winter in a new district. At first fortune favoured us, and about 10° west of our previous winter station we once more reached 65°·5 S. lat. But here the new ice proved so thick that we were no longer able to break through it, and therefore did not again reach the coast. On the other hand, the condition of this ice was nowhere firm enough to afford a site for a winter station. What we had unwillingly obtained from the snowstorm the previous year now baffled all our efforts. We wanted to get blocked at various points in the ice; but everything was again broken up by the next storm, which bore us with the current northwards to the open sea. In this respect our experiences differed essentially from those of earlier expeditions. For these earlier expeditions no longer entered the ice at such a late season of the year, fearing to get ice-bound for the winter, whereas we entered it for this very purpose, but failed in our object, because we again and again drifted away to the north.

After repeated essays extending over two months, it became evident that we should neither find a suitable winter station, since, owing to the young ice, we could no longer push forward to the still and shallow waters off the coast, nor yet be able, on the other hand, to extend the coast voyage any further, since the young ice was already too strong, while the period of work was too short owing to the increasing darkness. I therefore decided to leave the ice, and this took place on April 9, 1903, after another storm had once more deprived us of any halting-place.

The results of the expedition cannot be comprehensively surveyed until the whole material and the copious collections, all of which have been brought back in good condition, get worked up and made accessible. It may, however, be already affirmed that the *Gauss* Expedition achieved everything in the region assigned to it that it was possible to achieve in the time available. It has discovered a new land, and thereby cleared up an old contested question regarding the nature and extent of the Antarctic continent for over ten degrees of longitude, certainly for about half of the debated region between Knox and Kemp's Lands, and perhaps also for the whole. At least, for the actual determination of the westerly tract, observations are now at hand by which light may be shed on the specified question. An important factor is the steep fall of the land down to a deep sea discovered by us; important, also, is the structure of the land, which consists of old crystalline rocks; lastly, it is important to find that this margin of the continent is occupied by a volcanic formation whose lavas contain molten gneisses which have been forced up with them from the bed-rock.

The inland ice covering the continent presents a picture of our former Ice Age, and is undoubtedly the vastest glacial area now existing. Yet it was still more extensive in former times, as shown by traces on the Gaussberg.

To this continent were directed our operations, which endeavoured to study all the phenomena presented by it. In the biological field, these studies ranged with Prof. Dr. Vanhöffen from the large marine mammals and the flocks of rare birds on the seaboard, through the numerous species of the smaller marine fauna to the bacteria which Dr. Gazert was able to detect, if not in the glacial sea itself, at least in its organisms, as well as in the rookeries of the stormy petrels on the Gaussberg, and in its few lichens and mosses. On the physical side, our observations extended from Dr. Philippi's studies of the Gaussberg lavas and of the continental boulders borne to great distances by the ice, through the numerous properties of the glacial sea and of the glacial formations by myself, up to determinations of the force of gravity, and to Dr. Bidlingmaier's determinations of the most delicate oscillations of the terrestrial magnetic forces, both in their normal periodicity and in their stormy perturbations, such as are displayed especially during the appearance of the southern auroras.



ICEBERG WITH DUST AND GRAVEL.

But should any one doubt that we there lived and worked in a new region on the fringe of the south polar continent, conviction will be afforded by the climate. In the north we had left behind us the zone of west winds and crossed a trough of low barometric pressure, remaining on its southern slope, where the pressure again rises to a maximum over the continent. Hence the prevalence of the easterly winds, which sweep down from the south over the vast uniform and but slightly inclined surfaces of the inland ice, and appear on the seaboard as easterly, Föhn-like gales.

These gales impart to the *south polar region its character and its limits;* by their frequency and uniformity they reveal the immensity and the homogeneous nature of those Antarctic lands. Their northern confines may have some importance for *practical navigation* whenever there is a question of circumnavigating the zone of the Austral west winds.

STRUCTURE OF THE ICE IN THE MORAINE ON THE WEST SIDE OF GAUSSBERG.

But in my opinion the aim and results of an expedition are not to be weighed by particular scientific and nautical determinations, however interesting in themselves, and however stimulating they may naturally again prove in individual cases. More important is the main outcome, the fact that in the expedition are focussed the most diverse forces and efforts in order to test their value when combined for some new undertaking in vast unknown regions. In this respect the nautical and technical experiences undergone by our noble craft are no less valuable than the fresh triumphs of industry which have placed at our service instruments, provisions, articles of sport and dress, and the thousand other objects supplied by the outfitters, or even than the methods of science itself adopted in our operations.

These were conducted in a new sphere of action, where no one could tell how matters would turn out under absolutely unknown conditions. Many things might miscarry when the ship was shattered or the instruments went wrong, and the energies of the expedition had then to be directed more towards the preservation of life and replacing the lost materials, efforts which merely yield negative results. But when an expedition happily returns, when it has succeeded in carrying out its plans and utilizing its appliances, and when in its new surroundings it has been able to modify in the right direction the principles of its being based on home experiences, then is obtained a series of positive results which may one day perhaps be able to enlarge even our own views. Such efforts are the goal of all expeditions in the wider sense, and should the future show that our operations yielded good results in this respect too, then our purpose will have been achieved; then will the newly discovered Kaiser Wilhelms II. Land, with the new knowledge yielded by it, become a foundation for fresh triumphs even in the home land.

Before the reading of the paper, the Chairman, Sir THOS. HOLDICH, Vice-President, said: Dr. Drygalski, who to-night is to give us an account of the German expedition to the Antarctic Regions, is, I believe, appearing here, favouring us with his presence, for the first time. He is, all the same, an old friend to British geographers. He is well known for his researches amongst the glaciers of Greenland, and perhaps even better known to a certain section of geographers, those who have had to deal with geodetic science in India, by the observations which he has made, and the correspondence which has ensued between Indian surveyors and those scientists in Germany who have interested themselves in the same subject. I think I need not go further in introducing him to you. We all welcome him here to-night as the representative of an expedition which in many respects has been working with our own in Antarctic Regions, and I have no doubt that you are impatient to hear from him an account of his own proceedings. I will now ask him to read his paper on the German Antarctic Expedition.

After the reading of the paper, the CHAIRMAN said: There are several gentlemen here to-night who can add to the interest of the meeting by making a few remarks on the very interesting paper which we have just heard read by Dr. Drygalski. Perhaps Sir John Murray, whose name must be well known in connection with the *Challenger* Expedition, will favour us with a few remarks.

Sir JOHN MURRAY: I have listened with very great and very peculiar pleasure to this interesting account of the work of the German Antarctic Expedition, which has been so beautifully and interestingly illustrated. The peculiar pleasure I have had in listening to the lecture is largely derived from the fact that the *Gauss* has followed in the track of the *Challenger*, not only on Possession island and on Kerguelen, but also in that part of the Antarctic, where she was frozen in for the winter, and where a most important part of our labours took place. We of the

Challenger Expedition firmly believed, although we could not touch ice with our unprotected ship, that with our dredges we were able to see more of the Antarctic continent than even those who ventured with sledges upon the snows of that continent, because in our dredges we dragged up fragments of that continent in very great numbers, and the minute study of the detrital matter associated with them distinctly showed to us that, in the most southerly point we reached, we were not very far from the Antarctic continent. We, of course, could not state in miles what distance we were from the continent, but the gradual increase in bulk of these fragments showed us that when we were sounding in 1900 fathoms and 1200 fathoms we were not very far from the continent. Prof. Drygalski has told me that he believes that had we tried at our most southerly point we should probably have got soundings on to that continental shelf on which the *Gauss* spent her winter. We believed, before the *Gauss* started, it would be very difficult indeed for her to find a harbour in that region. I for one was always opposed more or less to the views of Prof. Neumeyer, that there existed anything like a warm current running south in this direction, although it was shown on German maps, etc. They have proved by their work that this continent exists where we predicted it would be found, although we thought there could be no possibility of finding a harbour. I cannot help thinking it was a most fortunate circumstance that enabled the *Gauss* to get into the position she did, for Prof. Drygalski has just told us they were not very far from that portion of the sea where the ice was continually in motion, and I cannot help thinking she must have got into a sort of bay. Now, as a naturalist, I do not think any scientific man could have wished a better position for a ship than that which the *Gauss*, by a fortunate circumstance or by chance, secured, because there she was right on the shelf, the exposed shelf of this Antarctic continent, and I look forward with very peculiar interest indeed to the results of the work of the dredge in two or three hundred fathoms of water off that continent, and to the report on the numerous things collected there. I also look forward with very great interest to an account of the motions of the ice. I should like to know if the tides there first went in one direction and then in another, or if there was always a current in one direction. The fact that naturalists have been making observations in that sea for a full twelvemonth ought to be of the utmost importance to the scientific man in interpreting the phenomena of the Antarctic. I cannot do otherwise than to extend to Prof. Drygalski, to his comrades, and to the German people, our very heartiest congratulations upon the success which has attended the labours of this expedition. There was one other point which was mentioned, apparently incidentally: the fact that fifty scientific men are at present hard at work upon these collections; this seems to show us it will not be long before we get the results of this expedition for purposes of speculation and for further investigation. I was rather interested, and perhaps some of you might not have noted the point, when Dr. Drygalski said they heated the boilers with penguins. I have always maintained that the penguin was the most important animal of the Antarctic. I suppose they took the skins off, and then they put the skins with the abundant oil into the furnace and burnt them. And when he said they preferred the light of the penguins, I suppose he meant they boiled down their fat and burnt the oil in their lamps. There were many other points which were extremely interesting to me, and upon which it would be interesting to have Prof. Drygalski's further views. I must once more express the entire satisfaction that it has given to me, and I think the account we have received of this most excellent piece of work will give complete satisfaction to the British people as well as to the German. The *Gauss* has performed her part of this great international investigation with singular success.

Sir LEWIS BEAUMONT: I think we must all be united in our desire to give Prof. Drygalski a very large meed of praise for the way in which the lecture has been delivered, for it has been delivered with a great deal of spirit and originality, and the remarks which accompanied the illustrations certainly were extremely amusing. There is no doubt that the work that has been done, considering that the expedition did not reach those very high latitudes which it is always the object and aim of Arctic explorations to reach, is remarkable, and I think that the photographs which illustrated the lecture are also extremely interesting and very descriptive of the work done by the expedition. I am not speaking as a scientific man, but I am speaking as one who has had the privilege of being in the Arctic Regions, and I can say that I sympathize with and add my congratulations to those of Sir John Murray as appreciative of the great and important work which the German Expedition has done.

Mr. J. Y. BUCHANAN: I do not think that I can add much to what my old colleague Sir John Murray has said, except to emphasize his remarks about the importance of the expedition which was commanded by Prof. Drygalski. I, in common with Sir John Murray, listened with the very greatest interest to the thorough exposition which Dr. Drygalski has given of the circumstances and of the conditions he witnessed during his long stay there. I have no doubt Dr. Drygalski was at first disappointed at the position in which his ship became fixed, but for scientific purposes it was probably as advantageous as could be wished. It would be interesting to know if, notwithstanding the very great difficulties which must have stood in the way, Dr. Drygalski had been able to carry out, on the inland ice of the Antarctic continent, investigations similar to those that are so well known in connection with his name in Greenland. At this time of the evening I will not keep you by making any further remarks, but I simply wish to add my testimony to the great value of the work done by the German Antarctic Expedition.

Sir ALBERT MARKHAM: I came here this evening for the purpose of listening to the very interesting paper that Dr. Drygalski has given us, and not with any intention of taking part in the discussion which I was aware would ensue. But as the Chairman has kindly invited me to say a few words, I will, as one who has had some experience in polar exploration, and is therefore in a better position to realize the difficulties incidental to ice-navigation, and can appreciate the way in which those difficulties are surmounted and overcome, add my congratulations to those of Sir John Murray, Sir Lewis Beaumont, and Mr. Buchanan to Dr. Drygalski, on his safe return to his own country, for the good work he has accomplished in the Antarctic Regions, and also express the pleasure that we all feel in welcoming him here to-night. In spite of many obstacles, such as Dr. Drygalski has detailed to us to-night—obstacles due to severe climatic conditions, to dense fogs, to furious gales of wind which are always, in polar regions, accompanied by blinding snowdrifts,—in spite of all those obstacles, he has brought his ship, the *Gauss*, back again with valuable and important geographical and scientific information. The Antarctic campaign, which started some four years ago, has now practically come to an end. It was not very long ago that we had the privilege of welcoming Prof. Nordenskiöld, who was the leader of the Swedish Antarctic Expedition: this evening we have the honour and the pleasure of according a welcome to Dr. Drygalski, the leader of the German Expedition, and you will all remember that not very long ago, on Good Friday morning, the news was flashed across from the Antipodes informing us of the safe arrival of our own Antarctic Expedition, the *Discovery*, in New Zealand, and I am sure I am only voicing your feelings and the feelings of every Fellow of the Royal Geographical Society when I say we are looking forward in a very short time to offer such a welcome to Commander Scott and his gallant companions when they return to England, as they all so richly deserve.

Captain **Creak**: I am afraid I have not very much to add to what has already been said. I would, however, refer to the magnetic observations made during the expedition. We are looking forward with great interest to the examination of the observations that have been made, and from what I have heard from members of our own expedition and what I have heard to-night, I believe a most valuable contribution to magnetic science is assured. I will say no more, but will conclude my remarks by reminding the members that in both expeditions the differential observations were made with instruments designed by Prof. Eschenhagen, of Berlin, and it is with sincere regret that I learn that he is no longer alive to see the results of his work.

Dr. H. R. **Mill**: There is nothing that I can profitably add beyond expressing my own personal feeling of hearty congratulations to my friend Prof. von Drygalski for this most admirable exposition of the preliminary results of his expedition. I should like to have heard a great deal more about the meteorological conditions, as I understand that in that department also he has done excellent work, and in due time we shall receive the full report. There seems to be no doubt that this expedition has confirmed what so many previous expeditions suggested—that there is practically a continuous coast-line running from Victoria Land to a great distance westward, almost as far as the meridian of the Cape of Good Hope. This and many other results will come out more clearly when the full report of the expedition is presented to us, and it is most gratifying and characteristic of the thoroughness with which German scientific work is done that so many specialists are already busy in compiling and discussing the data collected by the expedition.

The **Chairman**: As good geographers, we are all of us more or less acquainted with the progress of discovery at both ends of the world, both in the Arctic and the Antarctic Regions. But there is a particular feature about the present expedition to the Antarctic which has not distinguished those which have gone before it. The key-note of these expeditions has been combined international action. Now, we welcome such international action for a great many reasons. For one thing, it most certainly points conclusively to the final elucidation of the unsolved problems that may still exist at both ends of the world. We shall arrive at those results more quickly, more accurately, more satisfactorily, no doubt, by the combined scientific research of nations generally than we could possibly do by our own individual efforts as a country. There may still possibly be some shadow of a doubt resting over that great Antarctic continent. We do not know exactly whether it is one great continuous land, or whether it may be more or less an archipelago, a collection of large islands intersected by narrow straits and inlets such as we find in lands further north from the Antarctic—in Patagonia, for instance. But whatever doubt there may be about it will certainly be overcome; we shall know fully what the physiography of those regions is. But one thing there can be no doubt about, and that is about the energy and the ability which has directed this expedition, and which has led to such great results and such high achievements. We welcome Dr. Drygalski as a brother geographer, and especially as a geographer who represents in a high degree the scientific character of the German nation. When we think of the extraordinary difficulties that he had to contend with, those long Antarctic nights, the darkness, not of hours but of continuous days, the ship isolated amidst the ice with nothing but the weird ice-shapes all around it, and a silence such as might almost be felt covering the whole of the vast ice area around; when we think, moreover, of those most unappetizing-looking fish on which they had to live, for my part I cannot but recall the sentiment which was expressed by the American ambassador lately in this hall, when Captain Peary was narrating similar experiences, when he said he was so glad he was not there. However, while speaking of the advantages of combined action on the part of many nations in such discoveries as these, we ought not altogether to forget what our friends in the Argentine Government have done for us. About this time last year it was my luck to visit the magnetic station which they had formed, not exactly on Staten island, but on an island called New Year's island, an island to the north of Staten island, which I conceive to be most important in connection with the observations which will be taken by all those expeditions working in the Antarctic seas. Not only that, but we must remember that when the Swedish Expedition was reduced to the last extremity, it was our friends the Argentines who sent a ship down, found out where they were, and brought them safely back. Well, we congratulate Dr. Drygalski on the success of the achievements which he has secured partly by his own skill and his well-known ability as a scientist, partly by the loyal co-operation of those who served with him. I am sure you will join me in thanking him most cordially for his kindness in coming here to-night and in telling us all about it.

Dr. DRYGALSKI: I thank you in the name of all my companions for the interest and the hearty welcome we have met with in England. It has been a very great pleasure for us to co-operate with the other nations, with England, the Argentine Republic, and Sweden, in the Antarctic Regions, and in such an unknown region as we have in the Antarctic, such international co-operation is in the highest degree desirable. The region is too large to be satisfactorily dealt with by one expedition, and every observation which is made has more value when it can be compared with similar observations made simultaneously elsewhere. The great point in the present state of Antarctic research is that different nations have been working in co-operation at the same time. In answer to the remarks made by Mr. Buchanan, I may say that from the winter quarters of the *Gauss* we could reach the coast and the Gaussberg, and we could make all requisite observations on the movements of the ice and their relation to ice-physics in the same manner as I did in Greenland ten years ago. Moreover, the situation of the German Antarctic station had the great advantage of being close to the sea, that is to say on the sea-ice itself, and so, besides the work on the land-ice, we could easily conduct our operations in the sea, our dredgings and soundings, and the bacteriological work, at the same time. In this way we also came to a knowledge of the land which is covered with ice. I am not aware that precisely similar observations have ever been made before, that is to say, that a knowledge has ever been gained of the magnetic forces, the tides, the force of gravity, the meteorological and other phenomena, at a fixed station over a sea 200 fathoms deep, with simultaneous observations of the same phenomena, for purposes of comparison, on a mainland coast 46 miles distant therefrom. Again I thank you all for the interest and the kindness we have found here in England, and I will conclude my remarks with the expression of my great pleasure that the *Discovery* has now returned to New Zealand, and I may at the same time express the hope that in the autumn of this year Commander Scott will reach his homeland with a harvest of rich achievements.

A PIONEER JOURNEY IN ANGOLA.*

By Captain BOYD A. CUNINGHAME.

THE main objects of the expedition whose results are here set down was an examination of the interior of the province of Angola from the sea-coast at Lobito bay†—a fine natural dock some 25 miles to the north of the port of Benguella—up to a point as near the present eastern boundary of the province as could be reached while the season was favourable, taking as the general line of direction the junction of the southern border of the Congo State with the northern border of North-West Rhodesia. The most easterly point actually reached was a spot some 50 miles east of the Kwanza river, where the highland belt sinks to a low depression.

Both the outward and return routes covered different ground, and included a triangular traverse of the littoral and mountain belts of the province, having a point (Kakonda) on the plateau some 200 miles inland from Benguella as the apex, the ports of Benguella and Mossamedes forming the extremities of the base. In addition, I also made a journey into the southern part of the province, in order to obtain cattle, from Lobango to Huilla, Chibia, and due east to the Kunene river; thence due south down the west bank of that river to Humbé, returning to Chibia in a north-westerly direction *viâ* Ediva and Gambos. There being no settlements of the first importance in the interior, the expedition did not attempt to fix the exact positions of Portuguese military stations and native villages, few of which are permanent, as changes of site are of frequent occurrence. But all other geographical, as well as geological, economic, and social points of value were noted as being of greater importance to the matter in hand.

The physical features of the province of Angola may be broadly apportioned from north to south into four distinctive belts, running north-east and south-west. The *coast belt* varies in width from 150 miles inland at Loanda to 40 or 50 miles at Benguella or Mossamedes, and is a sparsely watered, sterile region. Where water appears in any quantity, it is charged with mineral deposits and highly impregnated with sulphur: its constant use by man and beast is not only unpalatable, but involves some risk to health. Benguella itself, however, possesses a capital water-supply drawn from the Cavaco river. The carrier-path follows the course of this river for 40 miles, and a sufficient supply of water is obtainable thereon, though the river is a sand-river in the dry seasons. This belt is enervating, relaxing, and malarious; intensely hot in the wet season; but the average maximum temperature at midday in the dry season is 70° Fahr., whilst at night it falls sometimes as low as 58° Fahr. The great heat of the day is tempered on the coast by an almost constant sea-breeze, which generally dies down at sunset. The coast bears an evil reputation for unhealthiness, not wholly undeserved; but this could be considerably ameliorated by intelligent attention to the simplest sanitary regulations, and to the ordinary provisions for the control and segregation of the native population, floating and permanent. Both of these common-sense precautions are entirely neglected.

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* Read at the Royal Geographical Society, February 22, 1904. This paper has been written with the co-operation of Mr. J. Withers Gill, F.R.G.S. Map, p. 248.

† *Lobito bay*, notorious in the days of the slave trade as the then unsuspected port of embarkation of slaves, while British cruisers were watching Benguella and Novo Redondo, has a depth of water sufficient to float large ships, which could unload close in shore off the western arm.

The *mountain belt*, which extends for about 100 miles further inland, is the belt of luxuriant vegetation, of forests of lofty hard-wood trees, of fertile wooded valleys, and of fairly abundant water. The rivers, however, are sand rivers, and water is only to be obtained in the dry season by digging. Its characteristic features are its wildness and ruggedness.

From this the traveller climbs to the *plateau* or *highland belt*,[*] which extends from the Congo in the north to Humpata in the south, and has an altitude varying from 4000 to 6000 feet. Here the character of the country is undulating veld and prairie, and extensive well-watered, treeless plains. It is the home of vast populations of blacks, the haunt of such game as the rinderpest has spared, and the source of all the agricultural produce of the province. Its eastern boundary is some 70 miles east of the Kwanza river. Climatically, it is healthy and invigorating, and "a white man's country." The variation in temperature throughout the year is comparatively slight, the maximum at midday lying between 72° Fahr. and 59° Fahr.; the minimum morning temperature on the plateau lying between 50° Fahr. and 59° Fahr., while in the river valleys at the same hour it falls as low as 41° Fahr. to 43° Fahr. The *anopheles* mosquito occurs rarely here, and most generally in the vicinity of rivers. Malarial fever could, consequently, be easily controlled by an intelligent white population. Indeed, the missionaries resident in this belt report their own staff practically free of malaria, though it is for obvious reasons more prevalent among the travelling Boers and Portuguese traders, who contract it in the lower-lying belts.

The character of the fourth belt east of the Kwanza and up to the plateau of North-West Rhodesia, which was not visited by the expedition, is generally that of an inland depression formed by the basins of the Kassai and upper Zambezi. For some 180 miles eastward from its western boundary, in the direction of the Portuguese post of Mochio, it is known as the "hungry" country. To all appearances this qualification is not due to exceptional poverty of natural resources, for it is a level, well-watered, well-timbered, and beautiful tract of country, with a good soil. It is "hungry" in the sense that it is entirely uninhabited, and no food-supplies are procurable. For some hitherto unfathomed reason, it is a country tabooed. The native explanation is that "a king's curse rests upon it." This "hungry" country ceases some 20 miles west of Mochico. Thence for some 200 miles eastward to Nana Candundo and the upper Zambezi the country is low-lying, unhealthy, and swampy in many places, but elsewhere well wooded and generally densely populated. It is well drained by numerous streams and eight larger rivers, all running south. Amongst the latter are the Luena, Lumessi, Mfua, and Lufua.

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[*] The following table of altitudes will make the extent of the rise clearer:—

57 miles out of Benguella the altitude was 1350 feet.
117 „ „ „ „ „ 2500 „
120 „ „ „ „ „ 3000 „
160 „ „ „ „ „ 4800 „
180 „ „ „ „ „ 5400 „
200 „ „ „ „ „ 5900 „

THE "BURRO-BURRO."

Kakonda, a trading settlement some 200 miles from Benguella, formed the apex of the triangle previously referred to, and was our starting-point for the interior, and the objective of our return journey. The country along the sides of the triangle, from Benguella and Mossamedes respectively, to Kakonda is fairly well known and frequently traversed by traders and by the handful of Boers who trekked into Angola in 1880.* The whole of the transport of the country, such as it is, is in the hands of the latter. It has, moreover, been described by Serpa Pinto and Capello and Ivens amongst comparatively recent geographers, though our Benguella-Kakonda route was more direct than theirs, which took a southerly bend through Dombe and the country of the Killenges, thence northward to Kakonda, forming roughly the segment of a circle of which our route was an arc. As this portion of Angola, therefore, is fairly well known, my observations may more profitably be confined to the journey inland from Kakonda and back, where new ground was broken,† and to the journey to the southern portion in quest of oxen. They will more conveniently fall into the four divisions of (1) the journey north-east to Bihé; (2) the turn south to the Kissalonga river; (3) the turn west to Kakonda; and (4) the southern journey to Ediva and Gambos.

Quitting Kakonda on June 12, 1903, we arrived at Chisambe, a distance (registered by cyclometer) of 255 miles, on July 17, having followed throughout the traders' waggon road, roughly prospecting the country for some distance on both sides of the road. This road, which has permanently been converted into a waggon track by Boer transport riders, runs some way to the north of the carrier track followed by Serpa Pinto and Capello and Ivens. Chisambe is in the Portuguese district of Bihè, of which Fort Belmonte (210 miles from Kakonda) is the official centre. Belmonte recalls the name of Silva Porto, well known to geographers as the merchant-traveller of the Bihè and Lunda districts of Angola, whose employés crossed Africa in 1854 and met Livingstone, and whose help and hospitality to subsequent travellers up to the days of Cameron and Capello and Ivens is memorable. The whole district is thickly populated with natives, whose principal occupation outside their kraals is that of "carrying," or travelling for their headmen, to distant Lunda, the Kassai region, and Barotseland, in search of wax, rubber, and boys to fill gaps in the ranks of *servicaes*,[*] all of which find their way eventually to the coast ports.[†] The story has often been told, and it loses nothing in the telling when repeated round the camp fires by those born romancers, the African negroes, how Bihè, the mighty hunter from beyond Humbè, came into the country with many followers, and, falling in love with the beautiful daughter of the reigning chief, carried her off in the good old style of "those shall take who have the power," and then quietly took over the country with his bride. His followers copied so amiable an example, and mated also with the women of the country. The roving disposition of the Bihenos is thus accounted for as a trait inherited from their wandering forefathers. From this disposition has arisen their unique attitude towards the trade of the province.

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* A graphic description of this trek was given to us by one of the participators. Two hundred and fifty waggons left the Transvaal *viâ* Khama's country and Lake Ngami, entering Angola by the Humbè district. The trek lasted five years, and encountered disasters innumerable. The Boers arrived in Angola, having lost 250 of their people and some 9000 cattle.

† Serpa Pinto's route from Kakonda to Bihè was more southerly than ours. Cameron's journey to Benguella took him more to the north, as he approached Benguella through the mountainous region of Bailundo by the carriers' path. The waggon road approaches Benguella in a more direct line.

The district of Bihè has always been the *entrepôt* for the time being of the staple trade of the country. Products are collected by these enterprising travellers from regions at a distance quoted as fabulous by their more timid neighbours. In the days of the slave trade it was the great *entrepôt* of the multitudes of slaves shipped from Benguella; and the importation amongst them of strange tongues due to this fact is probably the reason why the evidence of language is weak in support of the evidence of tradition as to the origin of the tribe given above. Nowadays the fact remains that a considerable portion of the total exports of native produce from Benguella is obtained by the Bihenos, who act as intermediaries between the natives of the rubber-producing districts of the Congo basin and the European trading houses. The journeys they make are extensive enough to be remarkable, and they frequently extend over considerable periods of time. These journeys, commencing in undisciplined raids for slaves, have gradually, by the action of economic laws, and under the direction of white traders, been systematized into their present extensive commercial ventures.

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[*] A system of indentured labour recognized by the state. The *servicaes* are registered by their proprietors, who have a call on their earnings if they work for other people.

[†] The exports of rubber from Benguella for ten years have been—

		Kilos.	
1893	... ...	1,340,300	
1894	... ...	1,153,600	
1895	... ...	1,306,000	
1896	... ...	1,605,800	
1897	... ...	1,683,247	
1898	... ...	2,246,431	
1899	... ...	1,882,201	
1900	... ...	1,228,995	
1901	... ...	1,271,645	
1902	... ...	504,843	(decrease due to a Portuguese punitive expedition to the interior.)
1903	... ...	658,069	(for five months only to end of May.)

The male population not being stay-at-homes or fond of manual labour, there is, nevertheless, a very large area of ground under cultivation by the native women, mealies and manioc being the principal crops. Water is plentiful, and the soil is light and sandy except in the "marambas" and on the Burro-Burro plain, where it is black and peaty. The two latter are striking features in the journey. Marambas are the springs rising near the summits of the high belts, and draining off from the spongy soil into larger marambas, which eventually become rivers. This is a strongly marked characteristic of the elevated country along which our route ran. The road leaves the low wooded scrub and passes into an open space aptly comparable to a snipe bog, having a stream of clear water, sometimes 15 feet in depth and only a foot wide, running in the middle. They are the *bête noires* of a waggon traveller, as they mean usually some 50 yards of bog to be traversed, which it is necessary to "corduroy," before the sponginess disappears and the low scrub begins again. The Burro-Burro is a long treeless plain, 28½ miles long and from 12 to 15 miles broad, entered by the road some 180 miles distant from Kakonda. The sources of the Kunene and Kubango rivers are in the Burro-Burro. Six rivers in all were crossed in this section of the journey, viz. Kwando, Kwima, Kunhugamwa, Kutato, and Kokema. All were flowing south to the Kunene or Kubango. The road therefore follows the divide, the highest altitude recorded being 6080 feet at a point 150 miles from Kakonda, the lowest 5260 feet at Kunhugamwa river. Both the Kwando and Kunhugamua are at least 40 feet wide at the crossing, and the depth of water at the date of crossing (June) was not under 10 feet. The others were very roughly bridged with logs.

Granite, continued throughout the mountain belt, formed the country rock for some distance past Kakonda. Red sandstone hills appeared near the Kwima river, and continued at intervals, all showing strong impregnations of copper. Float quartz was very general, also beds of limonite, up to the Kokema river, when indications of felspar, diorite, and basalt appeared. North-eastward from Chisamba a flying geological survey was made up to Ondulu, which lies in a basin of calcareous rock showing frequent heavy outcrops of iron. This basin is some 5 to 6 miles in diameter, and has at its south-western and north-eastern corners high peaks composed almost entirely of iron ore; and at its north-western corner an occurrence of geysers or hot springs, with sinter beds, somewhat similar to those north of Victoria falls of the Zambezi.

From Chisambe the expedition turned south towards the Kissalonga river, whence it was proposed to cut a new track westerly as the crow flies back to Kakonda. Starting on July 17, and taking two days to cross the Kwito river, which is some 30 feet broad and 6 to 10 feet deep, flowing between high sandy banks, we reached on July 28 the Kokema river. This was fully 180 feet wide and

10 feet deep, with a current flowing lazily by flat sandy banks, and forming numerous lagoons and swamps, thickly fringed with reeds. On the south bank of the river at the point of crossing is the large kraal Gando, peopled by the Ganguellas, or "Stammerers," thus christened from their peculiarly jerky manner of speech, which is doubtless partly due to the artificial gap made in the upper row of their front teeth. Nearly all the active portion of the population was absent at the date of our visit in the rubber-producing districts. Enormous tracts of land were under mealie and manioc cultivation. The timber, which had hitherto been soft-wood scrub, useless but for firewood, was, at our outspan at Luma on August 14, some of the finest we had seen in Angola. Here the trees were 60 feet in height and 12 inches in diameter.

GANDO AND THE KOKEMA RIVER.

Travelling south between the Kissalonga and Kwanza, the daily treks averaged only 2 miles, a road having to be cut through dense wood scrub. Forty miles south of Gando, at the source of the Kamunui river, is another large kraal, Muvundu. This was the largest kraal seen in the country, its ring fence of sycamore trees being quite 1½ miles in circumference, and its population falling little short of 3000. From here I made a flying journey in a south-easterly direction to find and examine the Kwanza river. After travelling about 11 miles I struck the river, and exploited 35 miles to the east of it, and 10 miles along the banks both north and south. From a point of vantage I could see fully 20 miles further east than where I halted, and observed no change in the character of the country, its similarity in all respects to that through which my party had been passing being maintained. From native reports, I gathered that the depression of the sand-veld commenced about 70 miles east of the river. The Kwanza where I crossed was about 20 yards wide, with hard sandy banks, the water being from 10 to 12 feet in depth, and the current running strong.* It was full of crocodiles.

On August 17 I returned to Muvundo, and shifted the homeward course south-west by west in fulfilment of the intention to cut a road straight back to Kakonda, which was hit successfully on September 29.

The rivers crossed during the first part of this journey were the little Kissalonga, the Kissalonga, and the Kunde. The first named is a tributary of the second, and all three flow into the Kokema. The sources of all these rivers are given erroneously on existing maps. They all drain northward into the Kwanza. The next in succession was the Kakuchi, which is the first of the big rivers running south to the Kubango; then at intervals of 12 miles, running parallel to each other and separated by high belts, are the Kuchi, Kutato, and Kubango. The Kakuchi, across which we were only able to make a passable drift by the aid of dynamite, was 40 feet broad and from 8 to 10 feet deep, with hard sandy banks lined and flanked with enormous granite boulders. The Kuchi was 60 feet wide and 12 feet deep, with perpendicular banks of hard sand some 10 feet in height. It broadens out into marsh and small lagoons, and is doubtless an imposing stream when in flood. We crossed the Kutato at a point where there were rapids of great beauty. The drift had a dangerous look, but was successfully negotiated. It was 50 feet wide, and from 8 to 10 feet deep in the still water. The rapids were running very swiftly through huge granite boulders. The Kubango, which was 84 feet wide and some 6 feet in depth, had a swift current running between steep sandy banks. It also opens out into swamps and lagoons, thickly fringed with high reeds. Forty-five miles further on the Kunene, the most beautiful of all the Angola rivers, was crossed. It was 80 feet wide, 8 to 10 feet deep, with high sandy banks 8 feet high. The current is swift, and the many granite boulders in its hard sandy bed form numerous rapids. On the east bank of the Kunene at Koloiko, a range of sandstone hills (altitude 5695 feet), in which considerable quantities of conglomerate were observed, was traversed. The Liamengo, the Calae, the Kwando, and Kalapi were also crossed on our return journey to Kakonda.

It is worth mentioning here that I was told by a white settler, but was not able to verify his interesting statement, that there were the ruins of a fortress-like building of unmortared granite blocks in the neighbourhood of our second day's trek from the Kubango. It remains for some more fortunate traveller to find and examine these relics, and compare them with the well-known "ancient ruins" of Rhodesia. It would be a discovery of startling interest should anything similar be found so far west.

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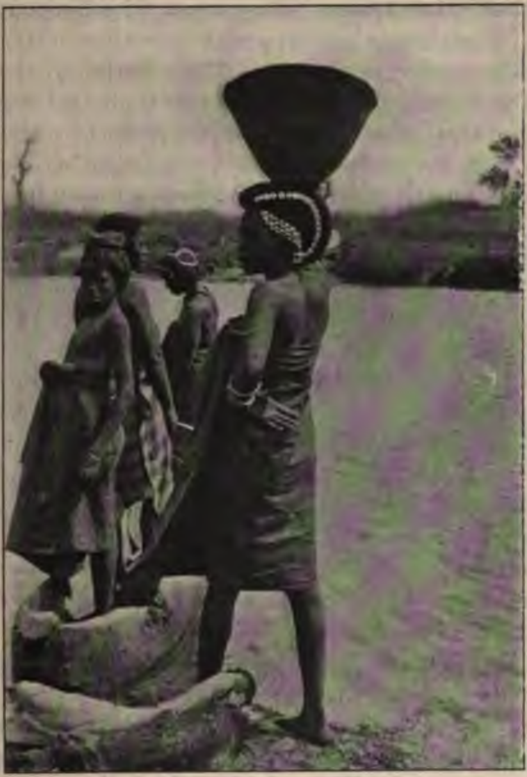
* Serpa Pinto must have crossed the Kwanza some miles to the south of this point; Capello and Ivens a little further north. The disparity between the breadth of the river as reported by them respectively and here registered was doubtless due to the season, my visit occurring at the height of the dry season.

Geologically, the country traversed on this return route was far more interesting than on the outward journey, and on this account it is deserving of further examination, especially the high ground east of the Kunene, where large outcrops of auriferous banket were found. The country was still densely populated, some of the kraals containing 2000 to 3000 inhabitants. A very picturesque setting is given to the kraals by the general custom of planting a fence of graceful sycamore trees (*cinchotina*) round the entire collection of huts.



GANGUELLA WOMAN, SHOWING HEAD-DRESS

The principal tribes east of the Kunene are the Ganguellas, Lumibas, and Luenas—all timid, friendly, and pleasant people. They were most hospitable to the expedition, and exhibited no warlike tendencies. Several of the kraals visited were peopled entirely by blacksmiths working the abundant ironstone.* It is a notable fact that apprentices are sent from great distances to these "smithy kraals" to be taught the art of working that metal. It was distinctive of these kraals that the huts were shaped exactly like a megaphone. No variation from the often-described tools and plant of similar artificers in other parts of Central Africa was apparent. These people own a few cattle, which they procure from Barotseland. They wear larger loin cloths than other tribes. They are a friendly, industrious, and peaceful race. Their kraals live harmoniously with each other, frequently owning a mealie garden in common. Their territory extends from the Kwanza to the Kubango. It was up to this limit that their head chief Chavana, whose kraal is at Ochisaya on the Kakuchi river, gave us safe conduct. In fact, his representatives accompanied us sometimes in a body sufficiently numerous to turn our prosaic caravan into a triumphal progress. A hundred singing and dancing natives would precede the waggons, to professedly point out the best road, to command in the name of their over-lord presents at the villages passed *en route*, and to perform many kindly services, sometimes useful, sometimes embarrassing. Every detail of our daily existence excited boundless interest. Hundreds of pairs of eyes intently watched my ablutions, the interest becoming breathless at the shaving and tooth-brushing stages thereof. And on one occasion quite 500 natives sat round our breakfast-tables. We lived literally "in the public eye." It was at this portion of the tour I became a practised adept at receiving deputations, and realized what hard work it entails. The primitive simplicity of these people may be gathered from the following episode, which occurred on the Kokema river. An old native harangued us loudly, as follows, in a speech which doubtless lost none of its point in passing through the interpreter's brain, but it is taken down as literally as possible, and not intentionally modelled upon the Hebrew prophets:—

"Who are these people? They are more than men. Nothing daunts them or hinders their progress. Rivers they cross with extraordinary ease and speed. Through thick bush they travel as rapidly as in open country. Fish in the river they slay as many as they desire. Birds flying swiftly and high in the heavens are not safe from them. They roam the veld as fearlessly as the lion; they crash through it like the elephant. What nation are they of? Who are they?"

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* The ironstone common to this district is a ferruginous conglomerate—a brown iron ore cementing small water-worn quartz pebbles. After long exposure, when the quartz pebbles have been washed out by denudation, the ore is black and cinder-like in appearance. It is an ore very commonly used by natives for smelting, as it contains an appreciable quantity of silica, which, forming a flux, makes it easily fusible and easily worked by their primitive methods.

From the Ganguellas country come large quantities of the rubber that is classed at Benguella as "second quality." It is gathered from the root-sucker of a creeper, probably a Landolphia.

Brief mention may be made of the game seen or procured by the expedition. The country being thickly populated, this was never very plentiful, but, on the other hand, we were never at any time short of fresh meat. It is comprised in the following list, viz. lion, elephant, hyena, jackal, buffalo, leopard, eland, roan antelope, water-buck, blue wildebeeste, letchwe, reed-buck, oribi, duiker, steinbok, blauwbok, bush-buck, hippopotamus, spring-buck, kudu, zebra, wild pig, and wild dog. The fish also caught were the African yellow fish, barbel, crocodile fish, and a species of bream. The latter lives in the "runs," and is naturally the best eating.

KAKUCHI RIVER.

Turning now to the journey taken through the southern portion of Angola in search of cattle, it is interesting from its striking contrast in the physical characteristics of the country and people to those just described. Mossamedes was the port where the expedition disembarked and fitted out for Lobango. The country between that port and Lobango, with its long weary stretch of "thirst land," calls for little mention. Amongst others, it has been traversed and described by Capello and Ivens in their journey in 1884 to the Zambezi.

North of Lobango the general character of the country is hard-wood scrub and what is known in South Africa as "sour veld." South of Lobango lies the cattle country, which is low-lying and covered with sweet grass and thorn bush. The route taken was from Lobango to the Portuguese trading settlement of Chibia, thence due east to the

Kakulovar river (called by the Boers "Honing" river on account of the sweet grass abundant there), following the course of the Chipungo river to Luseke on the Kunene, where the Kwe river enters the latter. Thence I travelled south along the west bank of the Kunene, following a track once before travelled by a Portuguese waggon-owner. Not without misgivings as to the result, I passed through the Mulondo* country, into which neither Boer nor Portuguese will now venture, and paid a visit to Dongulla, its chief kraal, where the king Hangara resides. This potentate has a most evil reputation, and the whites scrupulously avoid coming into contact with him, as he is credited with contributing to the disappearance of several travelling parties. His aptitude for removing obstacles of this nature and appropriating their property was unpleasantly impressed on me before my visit. The Mulondo people are a wild, independent, and warlike race. They have thrice routed Portuguese expeditions sent against them. They acknowledge the suzerainty of Olulu, the king of the Kwinhamas, the great raiding tribe of the province, who are entirely independent and have never been subdued.

I was the first Englishman Hangara had ever seen. He was complimentary enough to inform me, at the close of our interview, that he could easily see that I was a very great man—"as great a man as himself." This tribute was not spontaneous, but the more gratifying in that it was called forth by the chief's admiration, not only for the studiously independent and dignified attitude I took care to maintain, but also for the punctilious respect for my own susceptibilities that I had exacted from the gentleman himself. We parted good friends, exchanging presents, Hangara receiving a bottle of whisky and a Bryant and May match-box, which he reciprocated with a nice cow and calf. A considerable portion of the Mulondo country is covered with an enormously thick elephant thorn scrub.

From Dongulla I went southward to Kiteve, still following the course of the Kunene. Kiteve occupies a position as malarious as it is picturesque on the banks of the Kunene, at the edge of the swamps, which are here about 1½ miles wide. It contains a Portuguese fort which has been ungarrisoned for fifteen years.† The inhabitants of the country had been decimated by small-pox at the time of my visit. Thence, still travelling in a southerly direction, I reached Humbe, where there is a Portuguese fort and a trading store. Humbe is situated a short distance from the banks of the Kunene, near the point where the Kakulovar enters the latter. Humbe was the most southerly point reached. It is intensely hot. The natives are a very fine type, being hard workers, good fighters, and having a demeanour which can be fittingly described as gentlemanlike. From Humbe I turned north-west along the right bank of the Kakulovar, through the country of the Ombanjas, who are another turbulent race. These people are very scantily clothed, and own large numbers of cattle. The next point of interest was Ediva, about 8 miles south of the Kakulovar. This place is called by the Boers "Lord Mayo's fontein," in recollection of Lord Mayo's hunting trip in 1882. At that time it was a celebrated centre for big game, but has now suffered considerably from the ravages of rinderpest. The Gambos country was also passed through, but it was then famine-stricken. The Portuguese fort here is well commanded by a huge black granite kopje, which is a landmark for at least 50 miles. At the top of it are extensive caves permanently occupied by hostile blacks who have never been dislodged. The Gambos natives are proverbially idle and lazy. One of the natural features of this country is the abundance of baobab trees of great size. A doubting native here took my bet of my rifle against his own cow and calf that I would pierce a good-sized tree, at least 10 feet in diameter, with a

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* So called from the abundance of the mulondo fruit. It is about the size of a cricket-ball, with a hard green shell, which contains scarlet pips like a pomegranate, and it grows on trees about 20 feet high. Serpa Pinto records a similar fruit under the name of "mapole" as being common in the Ganguellas country, but we saw none there.

† Capello and Ivens visited Quiteve in June, 1884, and reported that there was there a vast building which had been for some years in the occupation of a Portuguese, probably a trader.

KUNENE RIVER RAPIDS.

bullet. In great fear and trembling, the native lay down behind the tree to hear the bullet come through. Needless to say, I won the cow and calf. From Gambos I returned to Chibia, and thence to Lobango.

The following game were encountered on this trip, additional to the species previously detailed as seen on the northern journey, viz. hartebeeste, oryx, impala, ostrich, rhinoceros, and giraffe.

To sum up. The immediate objects of the trip were satisfactorily accomplished, and it is to be hoped that some slight addition to the geographical knowledge hitherto available has also been made. Save for the ordinary accidents of waggon travelling, which one must always expect and always be ready to cope with, everything went without hitch. Much of this was due, of course, to the forethought and experience that went to the equipping of the expedition, nothing being neglected in the way of the provision of requirements essential both for successful travelling and for the health and comfort of the white and black staff. Much, also, was due to the *personnel* of the expedition, who worked throughout loyally, contentedly, and with an admirable spirit of *camaraderie*. The black staff were always happy and contented; the white staff always interested and thorough. Infinite patience, an inexhaustible supply of good temper, unwillingness to anticipate evils, but facing them smartly when they came—it was this spirit which carried us through. While as regards health, we had the advantage of travelling through a highland country with an invigorating climate, and during the dry season, and no serious illnesses affected us on the journey when we had once left the coast belt behind us.

To the testimony of travellers in other parts of Central Africa not under the Union Jack, we can add our testimony to the gradual spread of the impression among the natives that dealing with men of British race means that rigid justice which is the strongest appeal to the negro mind. Amongst other investigations, it was necessary to make inquiries as to the possibilities of securing labour on projects within the province, and amongst the active tribes scarcely any hesitation was found in the asseveration that it would be forthcoming in abundance for Englishmen, for that was an assurance of fair wages and regular pay. Moreover, an incident was described to one of us by a leading merchant in Benguella as coming within his own experience during the past year. Amongst a crowd of rubber-carrying natives who came to his factory were four men from the Zambezi, who refused to take the customary present of *aguardente* which is served out preparatory to trading. They said they came from British country where "strong water" was interdicted, and were quite ready to trade without it. I do not claim that their refusal was due to a high standard of moral behaviour. It may be that they were fully alive to the advantages of trading with their wits unmuddled. But, in any case, it is a small fact with a big significance.

There is another small matter of general interest. I had to consider the advisability of confiscating all finger-pianos and other instruments from my native *entourage*, so universal is the nostalgia induced by music. At any halt it is possible that your men may sit under a tree and begin to play to themselves, when the meaningless tinkle will call up visions of the kraal they have left behind them, and their yearning for home becomes so irresistible, that without a moment's consideration they will abandon everything and break away, leaving you helpless. Again, the Kwinhamas, that wild tribe in the south to whom reference has already been made, have, in contradistinction to negroes generally, no musical proclivities; and it is a notorious item of experience that, should they collect together and start chanting in unison, they will inevitably have disappeared by daybreak. Though, by the way, chanting is somewhat of a euphemism for the unmelodious concatenation of raucous sounds produced on these occasions.

A "SMITHY" KRAAL.

In conclusion, the province of Angola presents many points of interest, and it is satisfactory to note that its natural advantages will soon be more fully exploited by British enterprise, with the concurrence of our old-time allies the Portuguese. Being the natural highway to the coast from the rich mineral inland region over its eastern border in the 12th parallel, it will inevitably possess in the future a closer interest for Englishmen than it has hitherto possessed in all its three centuries of European occupation. It must not be assumed, however, that the absence of any large amount of general knowledge in England of this province is due to inactivity on the part of the friendly nation to whom it belongs. From at least a century prior to the days of Capello and Ivens many Portuguese travellers have from time to time made adventurous journeys into the interior, both from Mozambique and the west coast. Rather is it due to the fact that the results of their labours have not been generally accessible, in some instances perhaps from motives of policy, in others from lack of either the desire or the opportunity to spread them abroad. If this brief sketch has thrown a more diffused ray of light athwart a portion of Africa, it will be matter for gratification.

After the paper (which was read at the same meeting as that of Major Powell-Cotton's paper on Northern Uganda, p. 56), the CHAIRMAN (Colonel G. E. CHURCH) said: The papers to which we have listened have been of immense interest, and have commanded your close attention. That upon Angola was on a section of Africa with which not all of us are very familiar. Angola was discovered by the Portuguese seven years before Columbus reached America, but no settlement was effected there until that made by Paul Diaz, the grandson of the great Bartholomew Diaz, who was the first to round the Cape of Good Hope. Angola seems very similar to the country on the opposite side of the Atlantic called Brazil, especially that part of it between 6° S. lat. and 17° S. lat., not only as regards climate, but in a geological sense. The basic rock, the gneissic, underlies very ancient rocks, while at the same time the land rises in plateaus. I believe that in 1641 the Dutch captured the strongholds which belonged to the Portuguese in Angola. They were retaken by a Portuguese fleet sent from Brazil. About that time the Dutch, under Maurice of Nassau, were endeavouring to settle the district near Pernambuco. These two lectures, relating to opposite sides of Africa, have conveyed to our minds the extraordinary features of the native tribes, and they bring up the thought that Africa long prior to any knowledge which we possess of it has been populated by races who have become very much intermingled, and especially in Angola there seems to be every evidence of a great number of ethnological characteristics which indicate raids and wars and mixing of populations. I was specially struck with the remark by Captain Cuninghame upon the ruins of some very ancient towns built of unmortared blocks of stone, that indicate the existence of a prehistoric race, which makes us wonder if Africa once had a civilization of its own. I can only call upon you to extend your cordial thanks to the two lecturers whose papers we have listened to.

QUEENSLAND.*

By Dr. J. P. THOMSON, Secretary of the Queensland Branch of the Royal Geographical Society of Australasia.

PHYSICAL FEATURES.

QUEENSLAND occupies the north-east quarter of Australia. The area of the colony, including the islands, is 668,497 square miles, and the coast-line about 2500 miles in length. Its physical structure is simple enough, and there are few striking topographical features, such as occur in the south-east corner of the continent. By this it must not be inferred that Queensland is destitute of mountain scenery, but on the whole its elevated features are less broken and distorted than in countries where bold ranges and deep valleys form conspicuous landscapes. The highlands occur chiefly in the neighbourhood of the coast. Under the somewhat general designation of the Great Dividing range, they extend, in a more or less continuous chain, from the extreme south-east corner of the colony, at Point Danger, northwards, and almost parallel to the coast, through its entire length to Cape York. This great coastal range forms the anticlinal axis of the entire mountain system, from which radiate numerous lateral elevations, that form the watersheds between the rivers flowing westwards into the interior of the continent, and those that empty into the Gulf of Carpentaria. In some places the eastern side of the range approaches to within a short distance of the coast-line, and some of its radiating spurs even encroach upon it. In the southern portion of the colony there are transverse ranges extending westerly and south-westerly from the Great Dividing chain, and these form the watersheds of the numerous streams that flow into the Darling river. The rivers which fall into the head of the Gulf of Carpentaria are separated from the Georgina and Hamilton and the Diamantina streams, that flows south-westwards into the interior of the continent, by Barklay's tableland and Selwyn and Kirby's ranges. Gregory range, a lateral extension of the Great Dividing range, running north-westwards, divides the waters of the Gilbert and Flinders rivers, both of which flow into the gulf. Drummond range lies between the waters of the Belyando river and those drained by the Nogoa and Isaac streams. The waters of the Burnett and Auburn rivers are separated from those drained by the Dawson river by Dawes range and its collateral offshoots, while between the Dawson river and the Comet intervene the Carnarvon and Expedition ranges.

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* Read at the Southport Meeting of the British Association, September, 1903.

Macpherson's range is a rugged and picturesque forest-clad chain of mountains, culminating in Mount Lindsay, 4064 feet above sea-level. All along this great frontier chain, whose crest is studded with lofty and precipitous peaks, the scenery is magnificently grand, and the climate delightful throughout the year. The soils are fertile, and the vegetation luxuriant. The elevations of the coast or Great Dividing range, that extends northwards, vary from 2000 to 4000 feet or thereabouts above the sea. The highest points of its crest occur in the Cook district, where Mounts Bellenden-Ker and Bartle Frere attain altitudes of over 5400 feet. The topmost peaks of this great chain of mountain ranges represent the earliest insulated rudiments of what is now the Australian continent. It was some time during the Palæozoic period—an era that gave birth to widely distributed land masses in many regions of the globe—that several predominating areas of elevation were projected above the surface of the vast ocean on the east coast of this country. These now form the principal topographical features that control the drainage areas of many coastal and inland streams, whilst they also exercise a material influence in modifying the heat of the summer season.

The river systems, as established and regulated by the broad physical configuration here indicated, may, upon geographical principles, be conveniently classified into four clearly defined categories. First, there are the rivers that drain the eastern slopes of the main range, and flow into the Pacific ocean. These are mostly comparatively short and rapid streams, that sometimes overflow their banks during abnormal rainfalls, and inundate large areas of low-lying country. Local physical conditions render almost the whole of their drainage areas effective, and consequently they carry an enormous quantity of water when flooded. It has, in point of fact, been estimated that during the phenomenal flood of 1893 the volume of water discharged by the Brisbane river was equal to the ordinary discharge of the Indus of Sukkur, and "very nearly equal to the maximum flood-season discharge of the Nile at Cairo." The principal rivers here are the Fitzroy, the Burdekin, and the Brisbane. The second system of rivers flows into the Gulf of Carpentaria, the third south-westerly into the interior at the continent, and the fourth into the basin of the Darling, in the southern portion of the colony.

The whole of the country, however, is naturally divided into but three great primary regions, each possessing distinctive physical and climatic characteristics. The eastern division comprises the whole of the immense tract of country flanked on the east by the coast-line, and on the west by the Great Dividing range. It is abundantly watered by the copious rainfall that is everywhere distributed over its surface throughout the year, and by the numerous rivers and small streams that traverse it. The climate of this district varies from a mild tropical type to one of the most invigorating and health-giving temperate zones of the globe. The remarkably fertile soils are of the richest and most varied description. They comprise the immense alluvial deposits of river-basins, the volcanic ejectamenta of tablelands, and the loams of the slopes. The forests are rich in valuable timbers, and everywhere teem with animal and bird life; whilst, within the tropical belt, prolific nature has clothed the surface with vegetation of unsurpassed luxuriance. Here the various scrubs are remarkable for the charm of beauty, and often are dense enough to exclude the rays of the sun. The mountain and woodland scenery is very beautiful, and the adjacent island landscape delightful, the climax of grandeur being attained in the mighty waterfall of the Barron river, of which so much has been said and written, both real and imaginary. In flood-time the wild sublimity of the scenery here is extremely grand, the rush and noise of the turbulent and sweeping flood-waters being indescribable, as they madly leap over the edge of the shelving precipitous rocks some 600 feet high.

The second geographical division comprises the whole of the watershed of the Gulf of Carpentaria. It lies wholly within the tropical belt, and is made up chiefly of extensive plains and undulating lands. The country is especially adapted for pastoral rather than agricultural purposes. There are, however, several scattered areas of remarkably rich, deep, loamy soil, mostly in the basins of the Batavia and the Embley rivers, on the eastern side of the gulf, that could be cultivated. There are fine forest timbers here, and the whole district is abundantly watered. The rainfall is copious, and many rivers traverse the country, chief amongst them being the Flinders, the Mitchell, the Gregory, the Leichhardt, the Norman, and Batavia. Several of these are navigable, although the extensive mud-flats along the shores of the gulf greatly interfere with the free movements of large vessels. As a first-class pastoral country, the district possesses many natural advantages that are entirely wanting elsewhere. There is, first of all, abundance of water, and the grasses are luxuriant and nutritious. At the mouths of the Batavia and Embley rivers there are commodious harbours, where stock could be shipped, and every facility exists for the establishment of industries and the further development of the resources of the country. The drawback hitherto has been the distance from the capital of the

QUEENSLAND. CORAL REEF NEAR CAIRNS.

colony, but, as railway extension is now being rapidly carried on everywhere throughout the country, the disabilities with which the district has formerly had to contend will not much longer impede its progress.

The third great division is the largest of all, and, in point of importance, only second to the first one. Indeed, it may be considered that this magnificent western district, comprising as it does the whole of the immense country west of the coast range, is in some respects superior to the others. It embraces the famous Downs country, which for richness of soil and magnificence of climate is probably unsurpassed in any other part of the world. Extending far away to the west, into South Australia, these fertile plains and rolling downs cover enormously extensive Cretaceous beds, holding artesian water at varying depths. The irregular, uncertain, and always scanty rainfall of the far western district was formerly a great drawback to pastoral enterprise. During seasons of prolonged drought, run-holders suffered greatly by loss of stock, for over the vast surface of the rich soil no grass could be obtained, and other forms of vegetation were parched and withered. Now there is happily a complete transformation of the face of some of the country. Stern and relentless nature has to a certain extent been subdued by the art of man, and vegetation now flourishes luxuriantly on the surface of soil abundantly watered from artesian sources, whilst thirsty stock no longer wander madly and helplessly about over parched plains in quest of much-needed water. The main trunk lines of railway extend far away towards the western frontier, and the country is becoming settled in places where formerly not a single habitation was to be seen. In many parts the land is covered with several varieties of dense low forests of acacia (*A. homalophylla*, *A. harpophylla*) and other varieties of "scrubs," as they are locally called. Where these occur they impart to the landscape a most agreeable and picturesque aspect, whilst the umbrageous protection they afford from the solar rays renders their presence everywhere welcome. The soils are generally black, sandy, and brown loam, varying in depth from a few inches to 10 feet or more. They are eminently adapted for fruit-growing and agriculture, as well as for grazing purposes.

GEOLOGY.

It speaks well for the organization and assiduous labours of geological survey when we are thus enabled, at so early a stage in the history of the colony, to deal with the geological structure of so large a territory. The rich mineral deposits that were early known to the pioneer colonists, who spent most of their time in prospecting the older rocks and alluvial areas of the country, have in no small measure contributed to the success of our investigations in this branch of human knowledge. The goldfields alone have tempted men to undergo hardships, privation, and even death in their attempts to penetrate the most remote and barren regions of the colony in search of wealth, and the miners' footsteps have been closely followed by the officers of the geological survey, whose duty it was to bring to light and elucidate the great truths hidden beneath the surface.

The geological structure of the eastern or Pacific seaboard district of Queensland, representing broadly about a third of the colony and probably one of the oldest regions of the globe, consists chiefly of a series of ancient stratified rocks of Palæozoic age, the older members of which are more or less metamorphosed. There also occur granite and syenite rocks of plutonic and of metamorphic origin, as well as bedded and intrusive basic igneous ones, of various ages. The fossiliferous formations that also occur amongst these ancient rocks are Palæozoic, Mesozoic, Tertiary, post-Tertiary, and Recent. In their distribution they are associated with beds designated locally the Burdekin, the Gympie, Star, and Lower, Middle, and Upper Bowen, the Burrum and Ipswich, the Rolling Downs and Desert Sandstone, and the Lower and Upper Volcanic series, with associated drifts.

QUEENSLAND. BLACK SWAN LAGOON, CANNING DOWNS.

It seems very probable that at some remote geological period, the eastern edge of this portion of the country extended as far seaward as the present outer fringe of the Great Barrier reef. At this time the district represented one of the ancient tableland regions that constituted a striking feature in the physical structure of the Earth's crust, before being modified by the natural process of denudation and other causes, which for ages have operated and continue to operate on the exposed surface of the rocks and soils. But although no longer possessing the distinctive features of a tableland region, there still remain the dominant areas of elevation that culminate in the peaks of the Great Dividing range, the coast range, and the loftier crowns of the Bartle Frere and the Bellenden-Ker mountains. Associated with these physical conditions are numerous detached hills and mountain masses, with broad intervening valleys and alluvial plains, traversed by many streams, the whole region being abundantly watered by a plentiful rainfall. The coastal waters here are dotted with islands that have been detached from the mainland by the natural agencies which have shaped the district, greatly diminishing its area by an immense belt corresponding in extent to the Great Barrier reef and lateral formations. The mineral areas of the colony are mostly located within the district now under consideration, and the natural resources here have in consequence been developed to a far greater extent than elsewhere.

The physical and geological structure of the western portion of Queensland is of an entirely different type from that which occurs in the east. Here there is a gentle and almost imperceptible surface slope from the main ridge westwards to the great central depression of the continent, the Carpentarian gulf, and the basin of the Darling in New South Wales. The rivers are mostly shallow, with broad and ill-defined channels, often dry in parts during times of drought. The scrubs and other types of stunted timber-trees, to which I have already alluded, take the place of the magnificent forests and luxuriant vegetation of the coast region. There is, however, a great variety of nutritious grasses and herbage, consequently the district is one of the very best for pastoral purposes, notwithstanding the somewhat scanty and uncertain rainfall, as compared with other parts of the country. But, luckily for the pastoralists, the operations of the well-borer's drill are frequently met with, and numerous overflowing artesian wells are scattered far and wide over a very large area of the territory. Most of the western district of Queensland, and very probably a great portion of the interior of South Australia, are covered by the water-bearing beds of the Lower Cretaceous formation. These are evidently developed over the whole of the rolling downs country, and consist of the soft stratified rocks upon which the widely distributed Desert Sandstone or Upper Cretaceous formation rests unconformably. There is reason for believing that this Desert Sandstone must at one time have covered fully three-fourths of the colony. It is a rock of exceedingly soft texture, and has in consequence been so extensively denuded that it now only occurs as isolated tablelands, supporting a very scanty vegetation, locally known as spinifex grass, and poorly developed timber.

QUEENSLAND. EMU VALE WATERFALL.

Here in this formation of the Upper Cretaceous strata are the Opal deposits, that lie embedded in the Desert Sandstone, where they have been found distributed over a wide local area. Opals occur in great abundance south of the town of Winton, in the Opal range, as well as along the tableland which separates the waters of the Diamantina and Mayne rivers. The Lower Cretaceous beds of this western division are associated with a formation of soft grey friable sandstone grits and conglomerates, now known to local geologists as Blythesdale Braystone, in consequence of its highly porous and absorbent structure, rendering it similar to the rocks of that well-known place called Blythesdale. Cropping out over a wide area of probably more than 5000 square miles of territory, it greedily absorbs the rainfall, and in this way acts as a feeder of the underlying water-bearing beds, whence the valuable artesian water-supply of the colony is supposed to be derived. The source, the extent, and ultimate destination of the artesian waters of Australia have long been a widely discussed subject. Until the recent investigations of the Geological Survey of Queensland set the matter at rest, it was generally believed that the artesian water-supply emanated from a source far outside the limits of the continent, probably in the lofty mountain regions of India or New Guinea, and geologists clung to this erroneous idea for years. It never occurred to any of them to seek for a solution of the problem nearer home. Then there is the question of destination to be considered, and this is still disputed. There are those who advocate the submarine leakage theory, based upon the assumption that an outcrop of the water-bearing strata occurs beneath the sea, thus affording an outlet for the accumulated waters absorbed by the porous intake beds of the Blythesdale rocks, on the higher levels of the Lower Cretaceous country, representing most of far western Queensland. My own observations and experience have, however, convinced me that the theory lacks confirmation and support in the light of our present knowledge. Considered from a geographical standpoint, the idea is most improbable, seeing that the whole central depression of Australia is almost entirely circumscribed by a ring of impervious Palæozoic rocks, rendering the escape of water from the retaining Lower Cretaceous beds of the inner basin impossible.

As I have already dealt with this quite recently in a somewhat lengthy paper contributed to the Royal Geographical Society of Australasia, Queensland, and published by that body,* nothing further need be said here except to add that the recent discovery of an immense subterranean supply of excellent fresh water stored in an enormous basin north of the head of the Great Australian bight, furnishes the weightiest possible evidence in support of the view which I have always expressed—that there is no extensive submarine leakage of the waters of Australia. And no other conclusion is possible if considered from a geographical standpoint.

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* "The Climate and Artesian Waters of Australia," *Queensland Geographical Journal*, New Series, vol. xvii. pp. 1–32.

In the north-west corner of the colony there occurs a development of Palæozoic rocks, which runs west into South Australia. From its eastern rim or apex, which coincides roughly with the 141st meridian, this ancient formation spreads itself out towards the north-west and south-east, crossing the western boundary of the country between the parallels of 24° and a little north of 17°. It is believed that these impermeable rocks are covered by the water-bearing beds of the Lower Cretaceous formation, but there is no satisfactory evidence in support of this view, which can only be regarded as tentative in the light of our present knowledge. It is somewhat significant that no true artesian water has yet been discovered within the area in question.

BULLOCK TEAM WITH PINE LOGS ON RANGE AT CROHAMHURST.

The fossil drifts, or post-Tertiary deposits of Western Queensland have yielded abundant evidence to show that at one time in the geological history of the colony this district was occupied by several remarkable types of gigantic animals, of which the fossil bones of the huge semi-wombat (*Diprotodon Australis*), the marsupial lion (*Thylacoleo carnifex*), the gigantic kangaroo (*Macropus titan*), the wombat (*Phascolomys*), the *Nototherium*, the alligator (*Palimnarchus* *pollens*), the moa (*Dinornis Queenslandiæ*), and many other remarkable forms of life of a bygone age, are the only remaining traces to be found. The molluscan fauna of the period in which these gigantic animals abounded, as revealed to us by the numerous fossil bones exhumed from the post-Pliocene drifts, shows clearly enough that in post-Tertiary times there occurred in western Queensland, and over a vast area of central Australia, great marshes, extensive lakes, and broad streams, the whole physical conditions of the region indicating an enormous rainfall and an excessively moist, hot climate, highly favourable for the development of a rank and luxuriant vegetation, upon which the vigorous faunal types of the age flourished. The local extinction of the pre-historic fauna was no doubt accomplished by the great climatic and physical changes that occurred over the whole of the region now under consideration.

Mineral Wealth.

Queensland is the third gold-producing colony of Australasia, although the mineral industry has not yet advanced beyond the experimental stages, except in a few settled localities, where auriferous mining is now being carried on upon a somewhat elaborate scale. Several well-known gold-bearing areas are wholly undeveloped, and many extensive tracts within known metalliferous belts of country have not yet been prospected. At present there are altogether sixty-nine proclaimed goldfields, besides sixteen mining districts. These are distributed over an enormous coastal region, extending throughout the eastern district, from the southern boundary of the colony to the far north, in Cape York peninsula. There is reason to believe that the mineral wealth of the country is enormous. Vast areas are yet unexamined, and untold treasures may await discovery. The gold-mining industry is divided into two very distinct branches—alluvial and quartz, each great in itself. During 1901 there were employed in these 9438 miners, made up of 7340 quartz and 2098 alluvial miners. The yield of gold for the year following was 860,453 oz., and the total yield to 1902 from auriferous quartz and alluvial deposits was 16,532,434 oz., equal in value to £55,472,314.

Besides gold, other valuable minerals occur in many parts of the colony. These include copper, silver, antimony, and tin ores; coal, opal, gems, bismuth, wolfram, manganese, and lead. The quantity of these raised from 1860 to the end of 1902 represents a total value of £11,463,961. This latter amount added to the former gives a grand total of £66,936,275, which represents the acquired mineral wealth of the country since separation from the mother-colony. The value of the gold and other minerals extracted from the rocks and soils of Queensland for the year 1902 was £3,310,600. Considerable as this sum may appear—and indeed is—each individual member of the entire population of the colony would only receive a trifle over £6 were it divided equally among them.

Owing to the very low market value of the metal, the *copper-mining* industry receives but very little attention at present, although the ore occurs in enormous deposits in parts of the territory, especially in the northern districts, where large masses of pure virgin copper are met with. Some of these are of enormous size. In one locality, on the eastern coast-line, the outcrop of copper ore resembles the rugged cap of a sharp-peaked mountain, with pinnacle-like points projecting far above and over the narrow base, the appearance of the great dentiferous pile being remarkably striking when seen from a good position.

PAUL BEK'S VINEYARD, QUEENSLAND.

The well-known Ipswich Upper Trias beds have yielded an immense quantity of coal since they were first opened up by the enterprising companies now engaged in this important industry. The actual quantity of coal raised in the state from 1860 to the end of 1901 was 6,695,523 tons, valued at £2,821,989. Most of this has been obtained from the Ipswich coal-measures, which are developed over an area of some 12,000 square miles. Coal-seams are known to exist in other localities, but the Burrum river outcrop of true Palæozoic coal is admitted to be the most important of all. It lies about 15 miles north-west of the town of Maryborough, where several workable seams appear on the river-bank. The coal is excellent, its quality being equal to that of the famous coal of Newcastle, New South Wales. There can be no reasonable doubt whatever that a most profitable industry could easily be established in the development of this coal-field.

Briefly, the position may be summed up thus: The coal-beds are immense; they are largely developed in the eastern district along the coast-line, in localities easily accessible by rail or by water. All of the outcropping seams may be wrought at a very low cost; most of the coal is of the very best quality, and there is every facility for transporting it to the principal eastern seaport towns, from Cooktown to Brisbane. Not only could the bunkers of the entire fleet of steamers now trading to Queensland ports be always stocked with coal from the colony, but large quantities could be exported after providing for local consumption. Building-stones form another valuable asset, the importance of which is hardly yet realized, marble, granite, and sandstone of an excellent description occurring over a very wide range in Queensland.

OTHER PRODUCTS.

Queensland is remarkably rich in vegetable products that flourish naturally under the congenial influence of a fine climate and soil. They are reliable indications of the geographical and geological conditions of the colony, as well as of the character of its climates and its soils. They differ in some important particulars from the natural products of the southern portion of continental Australia, in that they include many distinctive tropical types, which are not met with in extra-tropical regions, nor in the alpine zones of higher latitudes. In fact, the flora of the country possesses many Asiatic forms, and this feature is strongly marked in the eastern tropical district, where numerous Indian types are distributed over a wide geographical range. The *Pandanus* tree, which ranges to New Guinea, the South Pacific islands, and north to India, flourishes all along the Queensland coast, extending into the northern portion of New South Wales, where it intermingles with the vegetation of that country. The coastal fringe also includes in its vegetation other Indian types, the *Pandani* and the mangroves being, however, prominent, whilst the Asiatic forms still reveal their identity for some distance inland, where the leafy brushwood and cedar trees are met with. The Indian bamboo is rarely found in natural growth, but orchids are by no means uncommon in the rich tropical scrubs and forests of the north. It is, however, the prevailing *Eucalypti*, the *Acaciæ*, and other less pronounced forms peculiar to Australia, that give the vegetation of the colony its distinctive character. In favourable localities, the dense scrubs of the eastern district of Queensland surpass all other natural products in luxuriance. They develop enormously in the moist heat and rich soils of the coastal region.

The vegetation of the country has yielded an abundant harvest; already the number of species discovered is remarkably large. The *Phanerogamia* comprise 1366 genera, 3752 species, 275 varieties, and over 200 naturalized plants; the *Cryptogamia*, 449 genera, 1467 species, and 72 varieties. Although these include several plants that likewise flourish in India, the Malay archipelago, and New Guinea, it may be remarked that no typical Australian plants are met with in India. This community of vegetation alone indicates that probably these countries were formerly united, and, furthermore, that the typical Australian plants were either developed after the separation of the country from Asia, or that there existed a distinctive Austral flora, distributed over a region whose limit did not extend farther north than probably the equator.

QUEENSLAND. WHEATFIELD, CANNING DOWNS, NEAR WARWICK.

The forests and scrubs yield a great variety of valuable timbers, eminently suitable for the capricious requirements of man. These are used extensively for cabinet-making, ship-building, bridge-building, railway purposes, street-paving, house-building, and so forth. At the Melbourne Centennial International Exhibition of 1888 there were exhibited over five hundred varieties of Queensland wood, and it was estimated by the Colonial Botanist at the time that these represented "probably little more than one-half of what might be collected in Queensland, . . . for no country in the world has a greater variety of useful and beautiful woods." Unhappily, some of the splendid forest areas of the colony have been denuded of a great deal of their valuable timber trees, and until lately no properly organized steps have been taken to arrest the destruction of the state forests. Timber-getters, by paying a licence to the Crown, have been at liberty to fell the choicest monarchs of the forest, carrying off the pick of the timbers, and throwing aside all else to rot and go to waste, at the same time taking no heed to make good by planting that which had been destroyed by the axe. The whole timber industry in the past may be said to have been characterized by this improvident feature. It is to be hoped, however, that this destructive system will not continue operative any longer now that the newly appointed Inspector of Forests has taken up the duties of the office. The variety of grasses and economic plants, too, is not less remarkable than the timbers. Of the 360 kinds of Australian grasses, about three-fourths are met with in Queensland. Associated with these, in their natural growth, is an esculent herbage of highly nutritious quality, and it is doubtless owing to the natural commingling of these diminutive forms of vegetation that the famous pastoral resources of the country are everywhere unsurpassed. Most of the grasses possess phenomenal vitality, and even when apparently annihilated by crushing droughts, they shoot forth luxuriantly after a shower of rain. The economic natural resources, although full of promise, have not yet been fully utilized. There has been little or no attempt to develop them effectively, and this is no doubt owing to the greater attention bestowed upon other more tempting industries. All kinds of tropical and extra-tropical fruits grow abundantly in the wild state and under cultivation. Vegetable oils of commerce are met with everywhere, and fibrous plants are numerous, many of the fibres manufactured from the latter being of excellent quality. About eighty varieties from the neighbourhood of Brisbane have been successfully treated by the late Mr. M'Pherson, who obtained the highest awards for them at international exhibitions in Australia and elsewhere. They are very fine in texture, and it would pay handsomely to establish an industry for their manufacture. There is a splendid opening in Queensland for the manufacture of vegetable oils, especially the essential oils of the *Eucalypti*, of which several varieties are met with. There are altogether about 360 known economic plants in the colony, of which some 130 have been introduced.

The descent of many of the extinct animals of the *Nototherium* period is continued in the present one. The gigantic kangaroo, the native bear, opossum, native cat, dugong, dingo, lizards, alligators, and other species of prehistoric times, are fully represented by the smaller types of the present Although it cannot be said that there are any very clearly defined faunal regions in Queensland, betwixt which approximate lines of demarcation could be established, yet there are, as a matter of fact, certain recognized zones contingent upon the climatic and physical conditions of the country, to which a limited number of animals are restricted. This is especially the case with the kangaroo, restricted in its range to the comparatively open downs country and to the thinly timbered coastal regions south of Townsville; the cassowary, whose home is in the scrubs of the northern district; the crocodiles, that inhabit the tropical rivers of the coast, and other less important forms of circumscribed geographical range. The remarkable Burnett salmon, known as *Ceratodus Forsteri*, is found nowhere outside the Burnett river. It belongs to the rare family of Dipnoids, the only other known species being met with in the Amazon and in Africa.

COOKTOWN, QUEENSLAND.

Birds are both numerous in species and beautiful in diversity of colour. The rich and dense tropical scrubs and luxuriantly thick forests of northern Queensland favour a much greater variety of bird-life than is met with in any other part of Australia. Nowhere, except in New Guinea and in the famous forests of Brazil, is the avifauna of the country surpassed, or equalled, in variety of species and in wealth of beauty. Several of these distinctive tropical forms possess many characteristic features peculiar to some of the Papuan birds of the

Paradise family, particularly the *Manucodia*, *Chlamydodera*, and *Ptilorhis*. The cassowary of North Queensland finds a counterpart in the New Guinea species, and one of the kingfishers is common to both countries. Parrots and pigeons are abundantly represented in the whole of Australia, and they too are allied to the Papuan and Moluccan types. The remarkable mound-builders, the scrub turkey and northern scrub hen (*Megapodius tumulus*), are plentiful in many parts of the colony; the former is a bird peculiar to Australia, the latter is also met with in New Guinea and the Malay archipelago.

Reptilian life is well sustained throughout the entire territorial area of the colony. It is one of the worst manifestations of Nature's creative energy with which man has to contend. Snakes, indeed, are numerous, and certainly inimical to the higher as well as to the lower forms of animal-life. The decidedly venomous species are represented by several kinds—especially the death-adder, the black snake, the tiger-snake, and the brown snake. The first is a harmless-looking, diminutive, inactive kind of reptile, but strikes with marvellous rapidity and force when disturbed. Considering the outdoor life of most of the colonists—in the forests, scrubs, and plains—the mortality from snake-bite is remarkably low. Many of the northern streams are infested with crocodiles, but these dangerous saurians are not found in the rivers of southern and western Queensland. The large crocodile attains a length of some 24 feet. It is stealthy in habit when seeking to seize its prey, and strikes with terrible and relentless force with jaws and tail as well. Queensland is also rich in reptiles as well as in butterflies and other forms of insect-life. Both *Ornithoptera* and *Coleoptera* are very plentiful, the rich tropical vegetation being especially favourable to the development of an apparently bewildering number of species and varieties. The rich colours are very beautiful, and the size striking.

CLIMATE.

The climate of Queensland has rarely been justly estimated. As a matter of fact, the climate of the southern portion of the colony is unrivalled. Extremes of temperature are unknown. The summer temperature is warm, but rarely oppressively hot; in mountainous regions and on tablelands of even moderate elevation, it is decidedly cool, temperate, and bracing. The winter climate of this part of the country resembles that of Naples. There is a prevailing cloudless sky; the atmosphere is clear, dry, and invigorating; the nights are comfortably cool, and the days delightfully warm. Frosts are very slight, and of only a few hours' duration. This season is most conducive to health and congenial to outdoor life. The distressing hot winds, so frequently experienced in other southern colonies, are unknown here. The humidity is naturally greater in the coastal district than in the inland regions, where the air of the great western plains and rolling downs country is exceedingly dry and buoyant. The moist heat of the coastal belt is greatly modified by the refreshing sea-breezes and prevailing trade-winds. On the slopes and spurs of the coast range the temperature is comparatively low, and the air clear and bracing, whilst the atmosphere of the Herberton tableland is remarkably salubrious, keen, and refreshing. Persistent and irritating miasmatic disorders are entirely unknown in this elevated region, where the nights are frequently cold and frosts by no means uncommon. West of the coast range the temperature is sometimes high during the summer months, but it is a dry heat, and very little inconvenience or discomfort is experienced by Europeans engaged in mining and other laborious occupations. Taken on the whole, it may be honestly stated that outside the tropic the climate of the country is highly favourable to the European constitution. Queensland is thus partitioned into two distinct and well-defined pluvial zones, that correspond with the dominating climatic ones in a very marked degree. The eastern or coastal division is abundantly watered by a copious rainfall; the vegetation is in consequence luxuriant, and the soils exceedingly fertile. In the western district the mean annual rainfall is generally scanty, and not infrequently deficient in places. It gradually diminishes from about 47 inches at Toowoomba, on the top of the main range, to about 6 inches at Birdsville; and at

TORRES STRAITS. NATIVE CONSTABULARY AT DARU (UNDRESS).

Camooweal, within the tropics, and almost due north from the latter place, it is about 15 inches only. The natural effect of this minimum precipitation is everywhere felt in the extreme dryness of the climate, and this would indeed have rendered the pastoral occupation of some far west and remote areas altogether impracticable were it not for the valuable artesian waters with which they are now abundantly supplied. Since artesian water was first discovered in the storage beds of the Lower Cretaceous formation, which is estimated to represent 56 per cent. of the entire area of the colony, the borer's drill has pierced the rolling downs strata in all directions, and the result has been a complete transformation of parts of the country from their former dry and parched state to a happy condition of fertility. Taken altogether as officially catalogued, there are now over 934 bored wells in Queensland, most of which are west of the coast range, the daily average for each bore being 666,231 gallons, while there are several bores whose daily yield is from three to four millions of gallons apiece, and much of the water is suitable for irrigation purposes. Besides the bores, there are numerous natural artesian springs that yield a very large supply of good water, and these appear to occupy a belt of country between which and the central region of the continent there is probably some well-established connection, as they correspond in their peculiar characteristics with the thermal springs observed by travellers in that part of the country.

The temperature records of the colony are now well established. They very clearly indicate, by their maximum and minimum isothermic lines, that the heat is very rarely abnormal in any part; that there is, in point of fact, an agreeable uniformity in the thermometric range throughout the year. At Brisbane the mean shade temperature is 68°, at Roma 65°, Rockhampton 72°, Townsville 75°, and at Hughenden 74°. The wet season occurs in the months of December, January, and February, during which time thunder-showers are frequently experienced, and the rivers sometimes flooded. In consequence of a recent very serious and prolonged drought, much attention is now being given to irrigation and water conservation, not only there, but in other states of the commonwealth. Already some extensive schemes have been developed in the Murray basin by the New South Wales Government, and in Victoria and South Australia irrigation operations have been in progress for some time. But there is much doubt whether these will pay. In point of fact they have not done so to any extent as yet. Still, there is a vast future before the country, and irrigation in the coastal districts will certainly be developed on a sufficiently large scale to adequately meet the requirements of closer settlement, when the results are certain to be more satisfactory and the conditions of life correspondingly favourable. With water-conservation the case is quite different. It is now very fully recognized that a mistake has been made in allowing the whole of the copious rainfall to run to waste in the sea, when a portion of it could have been stored up to make provision for dry times. With this object in view, it is proposed to examine the watercourses systematically, and explore the catchment areas. In consequence of their comparative shortness, some of the coastal watercourses have rather steep declivities, and the channels are not impervious, both of which conditions are unfavourable to the storage of large quantities of water, and consequently the subject is one associated with some difficulties. In the Moreton district, for instance, this is especially the case. Here a system of reservoirs for water-impounding has been proposed. But no practical results have ever been obtained from the scheme, which to all intents and purposes has been abandoned. But in the sugar districts north of Brisbane, especially at Bundaberg and in the Burdekin delta, a good deal of the river waters is utilized for irrigating the fertile lands there, and the experiment has so far been satisfactory enough to induce the settlers to give the matter some considerable attention.

INDUSTRIES.

As a wealth-producing colony, Queensland occupies a position in the front ranks of the British Empire. Its commercial and maritime position is one of the most important in the southern hemisphere, being the key of the great ocean. It possesses some of the finest natural harbours to be found on the whole of the Australian continent, and an enormous stretch of over 1200 miles of the coast-line is protected from exposure to the Pacific ocean by a stupendous barrier reef of coral rocks, with its inexhaustible products of pearl shell and fishery, including *beche de mer* and tortoise-shell, whilst the favourable advantages it affords to all classes of shipping in navigating the coastal waters of the territory cannot be overlooked. Viewed from a national or territorial standpoint, the population of the state is absurdly small. It must indeed be obvious to all concerned that the full development of the great revenue-producing resources cannot be accomplished by the mere handful of some 510,515 people that now inhabit the country, the great majority of whom are urban dwellers. It is only by the substantial increase of the rural inhabitants that the latent wealth can be rendered productive. The comparatively small number of colonists may, however, allude with some satisfaction to the annual export trade, now amounting to over ten million pounds sterling. This is a very satisfactory record of progress, and affords striking evidence of the industry and enterprise of the people, who, in the face of numerous pioneering obstacles, and the drawbacks of early settlement, are loyally endeavouring to extend the British Empire in this fair land. The industrial resources of Queensland have drawn to its shores people of divers nationalities, who contribute to their development. Besides Britishers and other Europeans, there are Americans, Chinese, Japanese, Indians, Siamese, and Polynesians. The Pacific Islanders, or Kanakes as they are commonly called, are chiefly employed as labourers in the sugar industry, for which occupation they are eminently suited. For well-known scientific reasons, the white man is not fit to take the place of the Kanaka or Polynesian worker in the cane-fields of Queensland. It is a generally recognized fact that white people who live in the tropics become anæmic, and suffer more or less from malaria, the former disease resulting from a diminished supply of oxygen in the air, which by expansion becomes rarer in the high temperature of the tropical regions than in the temperate zone. Thus we see from actual experience, and as the result of scientific investigation, that the tropical cane-fields are inimical to Europeans, who, in consequence, cannot hope to ever compete with the natives of the tropics in cane-culture there.

The public debt of Queensland, amounting in all to £36,898,414, is really comparatively small for a state whose immense resources and vast natural wealth are beyond estimation, and has been almost entirely spent on railways, reproductive works, and immigration. Although some 2801 miles of railways are now opened for traffic, it is obvious that these pulsating arteries of commerce will have to be greatly extended over the country as territorial settlement increases. It will, no doubt, be found necessary to tap the northern portion of the state by a grand trunk-line of railway, extending to the shores of the Gulf of Carpentaria. This would place the capital city of Brisbane in closer touch with London and the great Eastern markets of India, China, and Japan, and would, moreover, help greatly to open up the unsettled districts of the country. As it is, the great interstate railway connects Brisbane with Sydney, Melbourne, and Adelaide on the south ; Gympie, Maryborough, and Gladstone on the north ; whilst Dalby, Roma, Charleville, and Cunnamulla in the far south-western division are also linked by rail to the capital city of the state. In the central and northern districts, the vast pastoral areas of the far west are pierced by the iron roads that connect the remote township of Longreach, on the Thomson river, with the important seaport town of Rockhampton ; Hughenden, on the headwater of the Flinders river, with Townsville.

The principal products of the colony are derived from three great primary sources—pastoral, mineral, and agricultural. The first of these is more fully developed than the others. It was, in fact, the parent industry, the foundation of which was laid by the early pioneers, who pushed northwards with flocks and herds from the mother-colony, in search of fresh pastures.

In the early days, even it was known that the vegetation and climate of the great western district are eminently suitable for stock-raising, and large areas are now occupied for this purpose. Alth ough cattle and sheep have been, and are now to some extent, pastured on the lands of the coastal region, the number is small compared with the great flocks and herds that have flourished on the famous pastoral lands of the rolling downs. It is, however, anticipated, that instead of being mostly used for grazing purposes, the rich and fertile lands of the Darling downs will in future be utilized for the production of grain, for which they are unrivalled.

In ordinary seasons, when not handicapped by serious droughts, the sheep, cattle, and horses in Queensland number some scores of millions. The wool, meats, and other by-products find a place in the world's markets, but the further development of this industry is greatly hindered by the difficulty sometimes experienced in readily placing the beef and mutton upon the European market. Both of these products are acknowledged to be of excellent quality; the supply is practically inexhaustible, and the cost very low. There is no reason whatever why the meat-consumers of the United Kingdom should not obtain their supply from Queensland. The question of transport is one that need no longer render this impracticable, since the ordinary passage to England is now so comparatively short that weekly supplies may be landed in London with unfailing regularity. The needed encouragement would thus be not long wanting were the very high qualities of the meat fully appreciated.

NATIVES OF BADU-MULGRAVE ON ROCKS AT GREENWALL.

The agricultural industry is limited to the eastern settled district, from Cooktown south. There is a broad coastal belt, south of the

22nd parallel, highly favourable to the cultivation of maize; the rainfall is more than 20 inches during the summer months, which is the rainy season there, and the soils are exceedingly fertile. Since the discovery of large supplies of artesian water, extensive areas of country have thereby been rendered suitable for agriculture that were formerly of no value for that purpose. This is especially the case with the rich pastoral lands of the west to which I have already alluded, where the climate and soil render them of immense value for the production of grain. It is no exaggeration whatever to state that in no other part of the world—and this cannot be too often reiterated—has nature provided a more suitable region for the grain-cultivator than the one under consideration, the only drawback being the occasional occurrence of droughts. It is, however, anticipated that this obstacle to closer and more rapid settlement will shortly be overcome by a well-developed scheme for conserving the rainfall and natural waters of the country. The whole of the agricultural forms in the state represent an aggregate area of about 26,288 square miles (including lands alienated by deeds of grant, lands sold by auction, and selected); some 714 square miles are under cultivation, including an area of 170 square miles under sugar-cane. The sugar industry is one of very great importance, and its bearing upon the present and future prosperity of the country can scarcely be overestimated. The sugar lands at present under cultivation chiefly comprise the rich alluvial areas of the coastal region, especially in the Mackay and Bundaberg districts, where large mills with elaborate appliances have been established at very great cost. The annual output of sugar reaches a value of close upon a million pounds sterling.

Land in Queensland may be easily and readily acquired from the Government on terms and in areas liberal enough to place it within the reach of all.

Tobacco grows to perfection in the Stanthorpe and Killarney districts, and it is locally manufactured to some extent, the quality and flavour of the weed being greatly appreciated by consumers. Coffee is cultivated in the northern district, east of the main range, where the soil and the climate are especially favourable to the growth of the plant. Cotton and arrowroot find congenial fields in the rich lands of the southern district, on the eastern side of the main range. Fruit-growing is an industry that has hitherto received very little attention, but for the extension of which there is great scope; while the ramifications of the pearl-shell industry extend over the numerous shallow submarine areas of Torres Strait, within the Great Barrier reef. Thursday island is the capital of the pearl fleet, and it is also the neutral camping-ground of a mixed population from all quarters of the globe, who are mostly engaged in pearl-fishing. The industry is an important one to the colony, and special legislative measures have had to be enacted for its proper regulation. Over 1250 tons of pearl-shell were exported during the year 1900, valued at £128,451. This sum does not include the amount realized for the many valuable pearls that have been found in the shells. Divers are employed to search for the pearl-shell in depths up to 20 fathoms, beyond which they cannot work without danger to life.

To the enterprising colonist, Queensland offers a very wide field for the establishment of industries, or for the further development of existing ones. Many of the goldfields only require the judicious investment of capital to develop them into profitable and permanent industries that would yield very handsome returns. The meat industry is yet in the experimental stage, so to speak, and to its future possibilities there is practically no limit. No systematic steps have yet been taken to supply the local markets with fish, although the coastal waters teem with fish of excellent quality. The agricultural industry and its associated branches, offer an unlimited field for the profitable investment of small capital, and the remunerative employment of agriculturists with very moderate means and practical experience. Irrigation has only yet been attempted on a very small scale, operations being chiefly confined to the lands of the lower Burdekin basin. The artificial watering of the lands will, no doubt, receive early attention in the western parts of the colony, now that artesian supplies of water have been obtained in country where formerly irrigation was impracticable. It is not possible to give even an approximate estimate of the areas of lands suitable for irrigating, but, broadly speaking, it may be said that probably the whole, or most, of the vast rolling downs country is naturally adapted for that purpose.

CHANGES IN THE LEVEL OF THE CITY OF NAPLES.

By R. T. GÜNTHER.

THE evidence for the changes of level of the coast of the Bay of Naples since the Roman times * is supplemented and confirmed by the evidence of alterations in the level of the city itself, but as most of those who have recorded this evidence have failed to realize the full extent of the land-movements, their descriptions are incomplete, involved, and often contradictory. In no case is this more clear than in histories of the Port of Naples.

It has often been affirmed that the ancient harbour of Naples was much further inland than the sea reaches now, being situated below the

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* Some account of the evidence for the changes of level of the Italian coast has been given in this *Journal* for August and September, 1903, and in *Archæologia*, vol. lviii. *Cf.* 'Contributions to the Study of Earth Movements in the Bay of Naples.' Oxford. 4to. 1904.

churches of the Gesù Vecchio and S. Giovanni Maggiore;[*] and opposite the *gradinata* (steps) leading to the latter church have been found ruins supposed to be of a lighthouse, which was built of good tile-bricks and contained a marble spiral staircase.[†] On the site of the Collegio del Salvatore a wall was found of great blocks of lava like that from Monte Olibano, laid without any mortar; according to the account given by Sponzilli, this wall was considered to be part of the mole of the Greek Parthenope.[‡]

According to some accounts, the earliest harbour became filled up and was succeeded by another near the church of S. Onofrio, where a street, the Vico Lanterna Vecchia, was named after the light of the Port. The second harbour was similarly succeeded by a third, constructed by Charles II. of Anjou (1285-1309), which is still in existence inside the mole, called the Molo Piccolo, now part of the Via Piliero. Charles II. subsequently began building the mole of a larger harbour outside, which was finished by his successor, and received the name of the Molo Angioino.

The quarter of the town which is said to have arisen upon the site of the two most ancient harbours rests on a subsoil of sand and marine deposits, and has received the name Porto. Were this the only evidence before us, we should be justified in assuming the remains of the ancient harbour of Neapolis to be as far inland as S. Giovanni Maggiore, but our assumption is shaken by the occurrence of Roman ruins, below sea-level, in the very quarter supposed to have been under water. To mention but a few of the localities where such remains have been discovered in excavations at a very low level, we may cite the Strade Ferrivecchi and Armieri (Loffredo, c. 29); in the Strada dei Pellettieri near S. Paolo was found the marble gateway which was put into the chapel of the old Royal Palace near the Arsenal (Summonte, i. 27); under the present Arsenal, tombs and the walls of porticoes and cisterns occurred at so low a level that Fabio Giordano thought that they must be the fish-ponds of Lucullus, which have also been identified with the low-lying remains under Chiatamone by Pontano and Celano; other ruins lie buried under S. Maria a Cappella on the Chiaia, and near the eastern end of the workshops of the dockyard was an "ancient bath" close upon 5 feet below water (Niccolini).[§]

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[*] Founded on the site of a temple built by Hadrian and dedicated to Antinous.

[†] The ruin was standing until 1680, when it was stated to have been demolished to make way for the new buildings of the magnificent Refectory of the Collegio del Salvatore, now the "Aula Magna" of the University.

[‡] In the author's opinion, Parthenope, if synonymous with Palæpolis, was not situated so close to Neapolis, but lay at the southern end of Posilipo (cf. *Archæologia*, vol. lviii.). The harbour referred to by Silius Italicus in the sentence "*Parthenopæ portus statio fidissima nautis*," cannot, therefore, be identified with certainty as the predecessor of the modern Port of Naples.

[§] To this list of Roman ruins which have been unearthed at a very low level, we may add the following: *opus reticulatum*, Pennino dei Moccia (Carletti, p. 70); walls

With the knowledge that the land is now at a level much lower than that which the Romans knew, and also that a subsidence of some 35 feet, followed by an elevation of 19 feet, has taken place in the dark ages, we have, as it were, a key to the questions that puzzled and sometimes baffled the historians.

Since the Angevins there have been a succession of harbour extensions to seaward, and consequently the early writers assumed that the march of the coast had always been in that direction and that the first harbours were close under the old town walls. The contrary is likely to have been the case, for before the post-Roman subsidence of the land, the quarter of Porto must have been high and dry, and a harbour could not have been any nearer the town than the Porto Piccolo, but may have lain rather further out. The Roman foreshore would certainly have extended beyond the limits of the shore in the thirteenth century, which is known, for Charles of Anjou erected the church of S. Pietro Martire "on the edge of the water" (Nobile), and the beach extended to the Incoronata.

How, then, is the tradition of a lighthouse near S. Giovanni Maggiore to be reconciled with these facts? The answer is to be found in the subsidence of the land during the dark ages. With the land 19 feet below the present level, the quarter of Porto would have been under water, and the sea would have broken at the foot of the town walls. Then, no doubt, small vessels may have found shelter under the lee of partially submerged *muricini* or the secondary walls, which seem to have been constructed on the south side of the town, and a light placed upon an ancient tower may have marked the anchorage. We would, therefore, explain the so-called mole of large blocks of lava near the Gesù Vecchio, as being parts of the walls of Greek Neapolis, and the tile-built *pharus* as a Roman tower which in the dark ages was converted into a lighthouse. It is difficult to fix the exact date at which these land-movements were in progress. The subsidence is recorded in a passage in S. Gaudioso, Bishop of Salerno, who mentions a violent eruption of Vesuvius, accompanied by the submersion of a part of Naples by the sea, at some time during the fifth and sixth centuries. A rising of the land is recorded in the chronicle of Santa Sofia, for on July 12, 1212, the sea is stated to have retired for 75 yards; and on Sunday, May 6, 1237, the sea retired for a bowshot from Gaeta to Castellamare.

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built of tiles and a Greek inscription under the Case de' Benedettini near S. Severino (Martorelli, 'Theca,' p. 474); foundations of *opus lateritium* and *reticulatum*, and fragments of columns under the Chiesa di Portanova (Cestari, 'Top. di Nap.,' p. 13; Celano, iv. 52); bases of columns and pieces of an architrave, under the Sedile di Porto (Martorelli, 'Theca,' p. 636); bas-relief of Orion, fragment of architrave inscribed Cæsar, and two large marble cats (Lettieri)—the former has been put up against a wall in the quarter of Porto, and is vulgarly known as the Pesce Nicolo, after the noted swimmer who used to swim with letters from Messina to the mainland in the time of Frederick of Aragon.

We owe to Petrarch a description of another retreat of the sea, which was accompanied by a great tempest and earthquake, on November 25, 1343,[*] during his visit to Naples as Nunzio Apostolico to his Eminence the Cardinal Colonna.

Now, although the "retirements of the sea" which are recorded from the thirteenth and fourteenth centuries are best explained as incidents of the rising of the land, we do not believe that the whole uprising of 19 feet took place wholly within those centuries. The history of the church of S. Leonardo on the Chiaia, also known as S. Leonardo dell' Isola nella Villa reale, shows that no very considerable upheaval of land could have taken place after the foundation of the church in 1028, an opinion which is supported by the record of houses existing on the site of S. Pietro Martire in 1075 (Grimaldi), and by the fact that other lowlying quarters had been built upon in very early times, witness the Sopportico Gajolari, the Church of S. M. delle Rose, the Strada Costanzi, the Strada Calcara, and the Rione and Sedile Calcara. Confirmatory evidence might perhaps be also obtained from the Church of S. Giovanni a Mare, which is said to have been built upon the foundations of an ancient temple (Niccolini).

At the time of the greatest subsidence of the land, two islands lay just off the shore. The largest, a rock known as the *insula maris* or Megaris opposite the Castello Lucullano, is still in existence, although connected with the mainland by a causeway and bridge.[†] The Chiesa al Salvatore was erected upon it in the seventh century, it was strongly fortified by the Normans in the eleventh, and their masonry may still be seen under the walls of the Castel dell' Ovo as it now stands. A second church dedicated to S. Pietro was founded in 1324. A short distance to the east was the second islet, the small Isolotto di S. Vincenzo, not much above the sea-level, which belonged to the monks of S. Vincenzo al Volturno, having been given in 882 to Majone, their abbot, and is described as a property "in portu Neapolitano."[‡] The Castel Nuovo now covers much of the property, but in the eleventh century the islet was still in existence, for in 1031 the monks of SS. Teodoro and Sebastiano litigated for rights of fishing in the sea around the islet. The next mention of it is probably dated after a considerable elevation of the land had taken place, for in 1280, the *isulilla* "sauda et destructa et dequastata et arida et sine hedificio" was given *in enfitensi* by the monastery[§] to Raone de Griffo, a member of a rich family who lived near the port. In 1383 it came into the possession of Summo de Griffo by purchase from the Abbot of S. Sebastiano: at this time it was the

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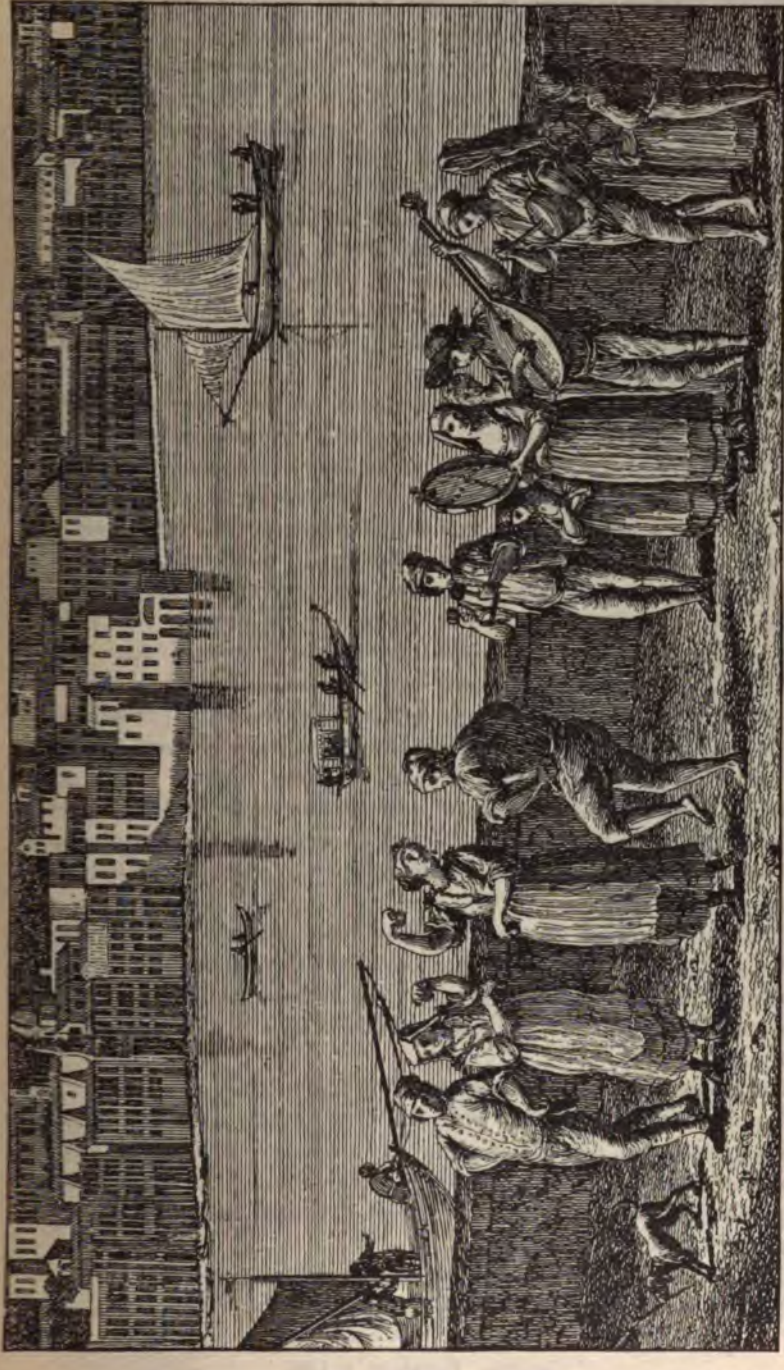
[*] The church of S. Pietro Martire is said to have been "buried in frightful floods" in this same year.

[†] The work of Zuniga, 1592.

[‡] Chron. Volturnense ex Cod. Barberiniano, f. 149. v.

[§] S. Sebastiano.



THE CHURCH OF S. LEONARDO (12) ON THE RIVIERA DI CHIAIA, NAPLES.

(*From an engraving by A. Cardon, dated 1765, after the picture by Gabriele Ricciardelli, entitled "Veduta di Chiaia dalla parte di levante.*")

custom of the Neapolitans to go and sit out on it in summer to take the air, and Charles II. is stated to have done so too.

In the fifteenth century, the Torre S. Vincenzo was erected in the sea, and it was found useful in some of Charles VIII.'s engagements with the Aragonese in 1495, and with the French and Spaniards in 1501. According to Capaccio, "e sia verso quel tempo" (*i.e.* about the time of the commencement of the works for the New Arsenal in 1577) "il mare ritornò indietro, e sia finalmente per la gran quantità di pietre e di terra, buttate nel mare circostato, l'isola spari e la torre, in certo modo restaurata resto nel continente."* The church fell into ruins. Charles III. (1740 circ.) used the tower as a prison for children who were disobedient to their parents, and it was probably demolished at about the end of the eighteenth century.

In conclusion, if our theory with regard to the historical sequence of the Earth-movements which have affected Naples be accepted, it follows that the real site of the Roman harbour of Neapolis has yet to be identified, and that it certainly lay much further south than is usually supposed. By a more or less gradual depression of the land-level, the classical foreshore became deeply submerged, until by the eleventh century the sea had reached a position not very unlike that indicated on the accompanying plan. The Isolotto di S. Vicenzo was then a well-defined island, the sea reached to the rising ground upon which the southern ramparts of the town were founded, and the harbours, the Portus Vulpulum and the Portus de Arcina, may have lain approximately in the positions shown. Niccolini seems to have claimed an even greater submergence of the land than ourselves, for one of his maps shows sea close under the eastern walls of the town, but the reported occurrence of buildings near the Mercato Vecchio and the Carmine at a very early date makes us hesitate to accept the coast-line as indicated by him.

A slight upheaval of the land may have taken place before the epoch of the great Angevin constructions of the thirteenth and fourteenth centuries, and this upward movement would have tended to increase a foreshore which was always being extended by the detritus from the town.

The upward movement was probably irregular in character. The rapid phase which coincided with the close of the sixteenth century has been noted, but, notwithstanding, the altitude of the land in Roman times has not been again reached, with the result that many Roman antiquities are now found below sea-level. At the present day a slight downward tendency is indicated.

The accompanying map has been prepared in part from a plan of Naples, illustrative of a memoir by Capasso, entitled "Topografia della città di Napoli nell' XI. secolo." * The scale is approximately 1 : 16,000, but is much distorted in parts, owing to the imperfection of the

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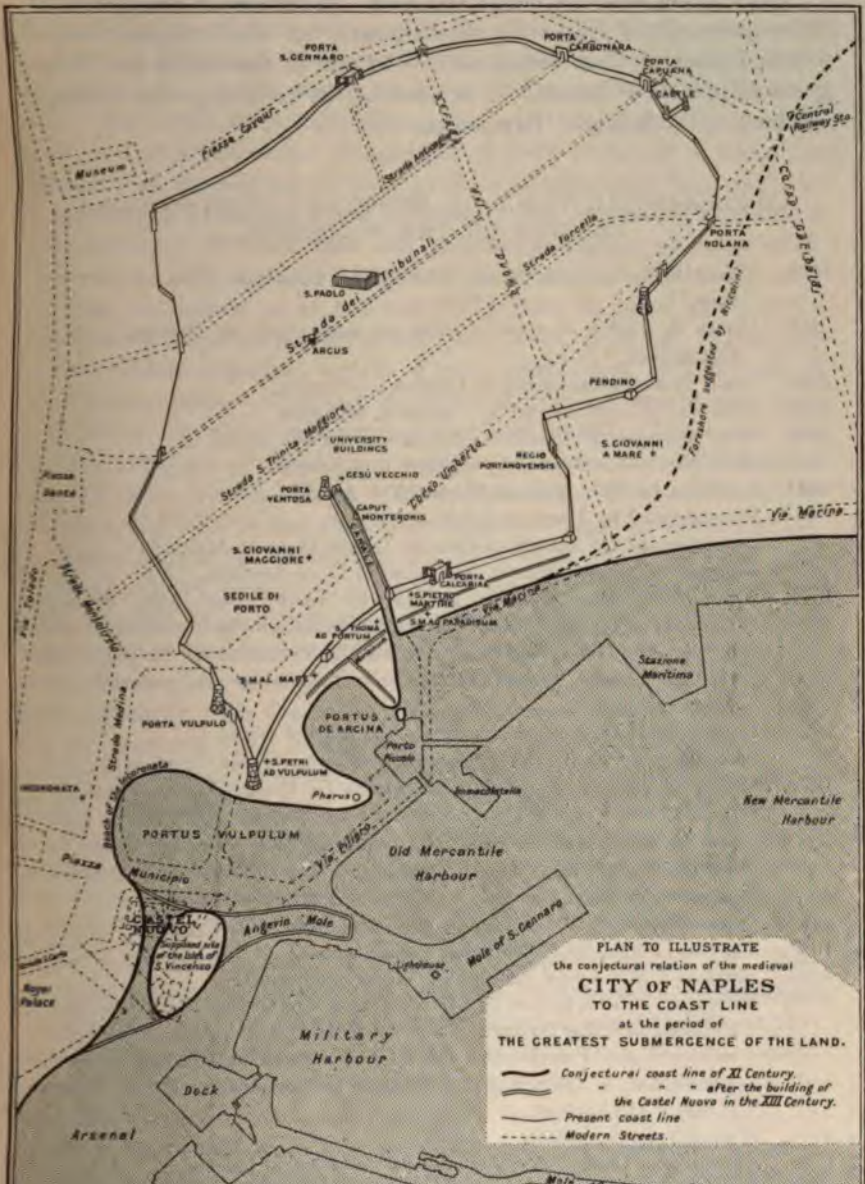
* Capaccio, 'Forestiero,' p. 1006.



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A PLAN TO ILLUSTRATE MR. GÜNTHER'S PAPER.

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* Published in 1895 by the Società Napoletana di storia patria.

representation of the course of the ancient town wall. The modern shore-line is from the Italian chart.

Many of the localities mentioned have disappeared in the process of the *sventramento* of Naples in recent years, but the interested reader will find most of them indicated by Carletti in the map to his 'Topografia della città di Napoli.' For a few of the references the author is indebted to Dr. Beloch's 'Campanien.'

CHRONOLOGICAL TABLE OF IMPORTANT CONSTRUCTIONS ERECTED ON THE FORESHORE.

1028. *Chiesa S. Leonardo a Chiaia*, founded by Leonardo d'Oria on a "small islet."
1224. *Chiesa S. Pietro Martire*, erected on land given by Charles I. to the Dominicans.
1283. *Castel Nuovo*, commenced by Charles I. of Anjou.
1285. *Molo Piccolo*, commenced by Charles I. of Anjou.
1302. *Molo Angioino*, or *Molo Grande*, commenced by Charles II.
1447. *Molo Angioino*, extended by Alfonso I. of Aragon.
1500. *Lanterna del Molo*, built by Frederick of Aragon.
Reconstructed by Pietro di Toledo.
Reconstructed by Antonio Alvarez di Toledo, Duke of Alva, 1623.
Restored to its present form by Ferdinand II. of Bourbon.
1577. *Arsenale di Sta. Lucia*, constructed by Viceroy Don Indigo di Lopez Mendozza, Marquis di Mondejar, who abolished the old arsenal which stood between the Dogana del Sale[*] and Sta. M. Visitapoveri. He commenced the fine Piazza d'Armi, which was finished by his successor, Don Giovanni Zuniga.
1578. *Dogana*, built by the same viceroy in the reign of Philip II.
Restored under Philip IV. by Don Inigo Guevara, Conte d'Onnate in 1653.
1578. *Chiesa Sta. Maria del Pilar*, built opposite the Dogana for the devotions of Spaniards who adored the saint under that title on account of her apparition to S. Giacomo in Saragozza, when she gave him her image on a column, called Pilar degli Spagnuoli: hence Piliero. A fountain has taken the place of the church.
1592. *Causeway and Bridge to Castello dell' Ovo*, made by Zuniga.
1668. *Darsena* (Dock), by Pietro Antonio d'Aragona.
1683. *Arsenale a Sta. Lucia*, fortified by Viceroy del Carpio.
1740. *Strada del Piliero*, formed by Charles III. as a protection to the new part of the town near the harbour. He constructed the bridge over the entrance to the Porto Piccolo; his other works were the Spianata with the Immacolatella, a second arm of the Molo Grande, and the Fort S. Gennaro to defend the harbour.
1755. *Molo dell' Immacolatella.*
1792. *Arsenal* near Castel Nuovo, constructed by General Pomereul.
1830. *Molo di S. Vincenzo* commenced. Extensions in 1868 and 1881, when the *Molo orientale*, the *Molo curvilineo*, and the adjoining dock were also planned on the eastern side of the new Mercantile Harbour.

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[*] The Dogana del Sale stood behind the theatre of the Fondo.

CANADIAN SURVEY METHODS.*

MAJOR HILLS' report on the Survey of Canada will surprise many who have had no better opportunity of judging Canadian methods than those afforded by the results, which are given to the public in the form of maps. As a rule, Canadian maps are so well turned out, so clear in detail, and so artistic, that the process of their evolution is taken for granted, and the impression they produce is altogether favourable to an assumption of accuracy and precision. But Major Hill's report is disconcerting. We find that the patchwork system of compilation from various sources, differing greatly in degree of reliability, is as prevalent in Canada as it has unhappily been in other parts of the world where maps have been trusted and found wanting. There has been no central organized system of map construction on the basis of sound triangulation—no strong backbone of well-determined and well-fixed points on which to base topographical detail. The result has been the usual one of time lost, money wasted, and much work repeated over the same ground. Major Hills condemns the provincial maps as valueless, and tells us that the better organized mapping of some of the mountain regions of Canada on the scale of 1½ inch per mile was finally abandoned on account of its cost. Even the "Geological" Survey maps are said to be rough in execution, and hardly worthy to rank higher than reconnaissance sketches. To those who have read certain recent works on surveying which have emanated from Canada, dealing more especially with the art of topography and phototopography, all this is surprising; for certainly the theory of map-making in all its smaller-scale branches seems to be thoroughly well understood by our friends across the Atlantic. The truth is that Canada has not sufficiently studied the results of those experiences in the older fields of the East which have been dearly bought at the expense of wasted time and wasted money—experiences which point to the necessity for systematic organization *ab initio*. No part of Major Hills' report is better worth study than his emphatic condemnation of the time-honoured notion that a trustworthy map can be compiled from irregular material, such as farm surveys, military sketches, and the like, or that such patchwork efforts can really be valuable even for the loosest military or administrative purposes. Major Hill's report gradually lapses into a treatise on surveys generally (with special application to Canada), and in this capacity it does little more than advocate the same doctrines that have been advocated by Indian surveyors for years past. The cheapest and the quickest, and indeed the only satisfactory, method of arriving at a trustworthy map of any country is to begin at the beginning with a strong central axis of first-class triangulation—triangulation, that is to say, of the class which has been applied to geodetic purposes, and which is executed with all the rigorous accuracy that geodetic science requires, but (in these days) without the cumbrous apparatus and consequent cost of old methods. Upon this must be based triangulation of a lighter character and of varying degrees of accuracy according to the nature of the country to be dealt with; but it must be triangulation, always triangulation, at starting. Major Hills' remarks about the correlation of linear with angular measurements are worth careful attention. Excessive accuracy in one function of a survey system is obviously wasted if others are not adjusted to the same level. This is indeed a matter which is constantly overlooked, even in such details as the relationship between the graduation and telescopic power of the ordinary theodolite. Major Hills' programme for the formation of a complete survey department for dealing (presumably) with Canada, offers certain points for criticism in detail, although it is most carefully worked out and full of most valuable suggestions. We cannot, in the first place, agree with him when he maintains that an absolute determination of longitude can be effected with much the same degree of accuracy as that involved in the determination of latitude. The most elaborate observations will sometimes fail (as in the case of the Madras determination), so much so that no geographical surveyor, in these days, ever wastes time over an absolute determination of longitude so long as he can preserve his position differentially by triangulation or by telegraphic time signals. Observations for latitude and azimuth, on the other hand, he repeats at every good opportunity. Nor do we agree with Major Hills' estimate of the strength in personnel required for a survey party. The "clerk and computer" would soon have to be replaced by a recorder and at least two computers. The system of computing in duplicate, which is adopted in India, is an admirable preventive against arithmetical error. The rapidity with which two computers will work against each other is an advantage, in the first instance. Certainty in result is, of course, the main object, and the possession of a duplicate copy at the conclusion of the work is a yet further advantage. A saving both of time and money is effected by duplicate computation. Nor are two triangulations necessary in order to keep six topographers supplied with material to work upon. But these are all minor details. As a framework on which to base an organized system of survey for a wide country, Major Hills' programme is admirable. As regards a military administration for surveys generally, Major Hills is not altogether correct in quoting India as an example of the successful adoption of such a system. The survey of India is directly under the control of the authorities of the Home Department of the Indian Government, and it is essentially a civil department, although it admits of the employment of military officers, and usually reckons an officer of the Royal Engineers as its administrative chief. The geographical surveys which are carried out during the progress of a campaign are conducted by officers (not necessarily military) of the Survey Department; but those officers can claim no military rank in the field, and do not even command their own escorts. With them is usually associated what may be called the sketching contingent of the Intelligence Department. Lately the senior officer of the Survey Department in the field has been officially attached to the Army Staff, but he is not always recognized by the general commanding as under his orders. The value of systematic and scientific surveys in the military field has not yet been fully recognized; out of the field, survey administration is purely civil. This system is one of the many anomalies which the strong hand of Lord Kitchener (himself a surveyor) may be expected to sweep away. It has led to a great deal of very irregular map-making.

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* 'Report on the Survey of Canada.' By Major E. H. Hills, C.M.G. With Maps. Intelligence Department, War Office. 1904.

We may, in conclusion, point out that an excellent article on the recent position of geodetic science has been written by Commandant Bourgeois in the April number of the *Revue General des Sciences* (edited by Mr. Louis Olivier, 22, Rue General Fay, Paris).

T. H. H.

MAP SHOWING THE WORK OF THE NATIONAL ANTARCTIC EXPEDITION.*

Note by the PRESIDENT.

We now present the Fellows and the public with a map accurately showing the discoveries of the Antarctic Expedition. Names have not yet been given, except in two or three instances.

It was compiled at Lyttelton, from numerous observations, by Lieut. Mulock, a careful and accomplished draughtsman, who joined the *Discovery* from the *Morning* in February, 1903. Lieut. Mulock had experience in sledge travelling with Lieut. Barne, and went beyond 80° S.

The positions fixed by observations, magnetic variations, soundings, heights, and the tracks of the sledge travellers are clearly shown, as well as the track of the ship to her furthest point along the coast of King Edward VII. Land.

The inset map shows the position of the discoveries with reference to the circumpolar area.

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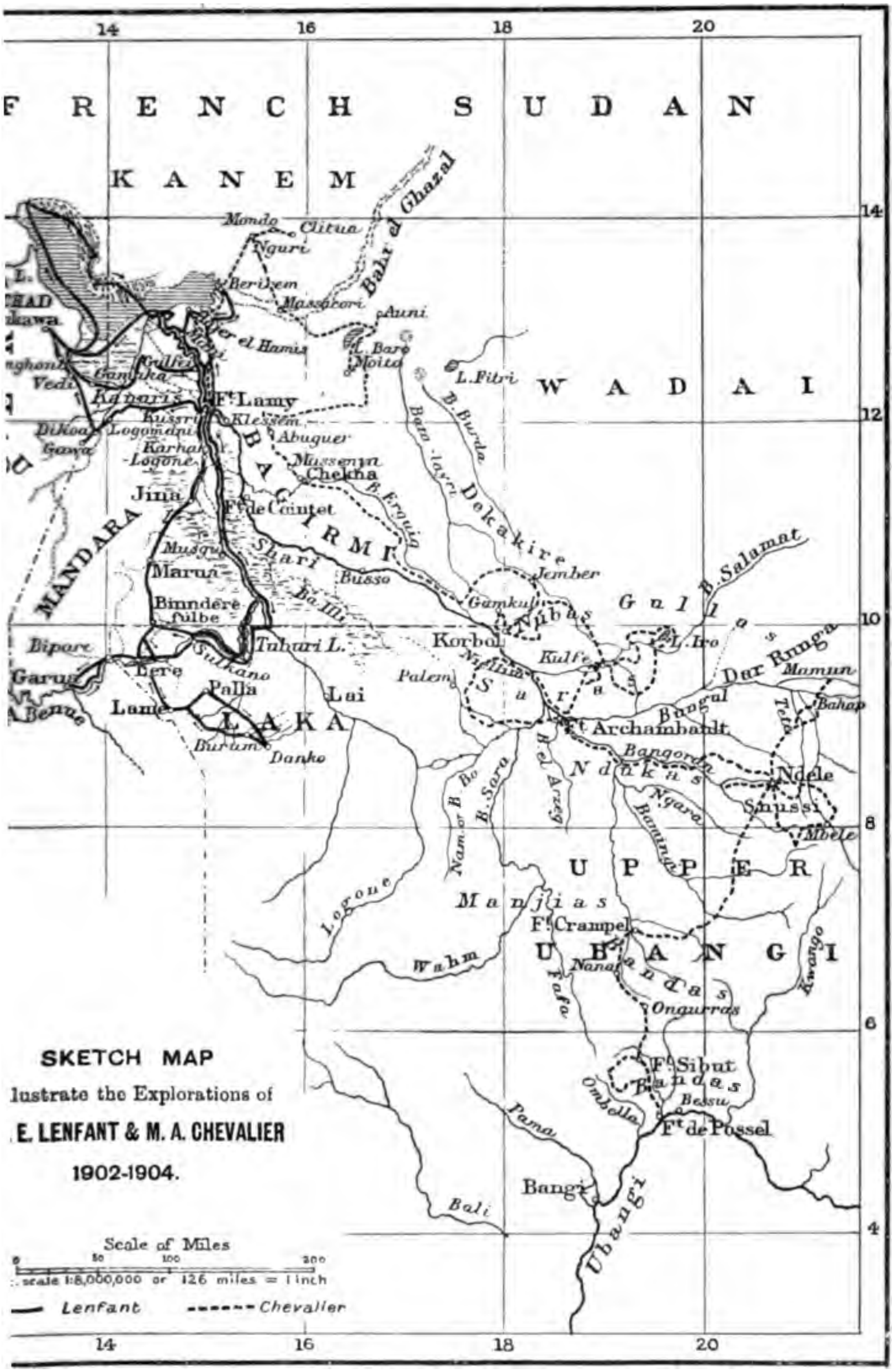
* Map, p. 248.

FRENCH EXPLORATIONS IN THE LAKE CHAD REGION.

TOWARDS the end of May, accounts were given before the Paris Geographical Society of the work of the two expeditions—those of Captain Lenfant and M. Chevalier—which have lately returned to France, after achieving such important results as regards the geography of the region around Lake Chad. Through the courtesy of M. Rabot, secretary of that society, we were favoured with advance proofs of the papers of the two explorers—since printed in *La Géographie*—which enable us to give the following condensed account of the expeditions and their geographical results.

Captain Lenfant, as is known, left Bordeaux in July, 1903, for the purpose of examining the capabilities of the route to Lake Chad by way of the Benue and Kebbi, which it was hoped would prove shorter and easier than those previously used by the Congo and Niger. He was accompanied by MM. Delevoye and Lahure, the latter of whom had been one of M. Duchesne-Fournet's party on his expedition to Abyssinia. For the river navigation he took with him a steel boat specially built for the purpose—the *Benoit-Garnier*—measuring 41 feet long by 8 feet wide and drawing only 2 feet when loaded. Thanks to the energetic help of Mr. Watts, of the Niger Company, the expedition was transferred to the steamer *Liberty*, and a start made up the Niger, within two days of the arrival at the Forcados mouth. On August 26 the German post of Garua on the Benue was reached, and beyond this the expedition relied on the *Benoit-Garnier* only. Before describing its navigation of the Kebbi, Captain Lenfant gave a general sketch of the geography of the region of the lower Shari, which he describes as an immense basin with almost imperceptible slope, extending from Dikwa in the west to Lake Fittri in the east, and from about the 10th parallel in the south to a "dune" or line of slight elevations, breached here and there, which runs south of Lake Chad, and is fertile and well peopled. The floor of this basin is composed of compact clay, and within it are included both habitable lands, such as the district of Musgu, and depressions covered by water, such as the Tuburi lake. The district of Kotoko, which extends from 11° N. to the mouths of the Shari, is a depression which receives the overflow of the Logone, and discharges its waters either into this river by a number of small channels, or into Lake Chad by a series of deep "Bhar," which showed a considerable current even at the height of the dry season. This depressed area is of so regular a surface that many channels have been hollowed out by the waters, and there are various waterways connecting the Shari and Logone. It would seem to be the basin of a lake formerly of much greater extent than the present, of which Lake Chad is the last remaining vestige, destined soon itself to disappear. There is a legend in the country which is of interest in this connection. The Saos—a former race—are said to have been of giant stature, and to have used earthenware pots capable of holding some fifty gallons, of which the men could carry three at once. In one year, when the rains had failed, the wells all dried up, and one of the Saos went to get water from the Logone, but on his return found the rest of his tribe dead from thirst. The Saos were probably the predecessors of the present Kotoko race, and the story may possibly indicate that, as a result of a drought lasting through several consecutive years, Lake Chad, whose waters formerly covered this region, fell considerably, and retreated behind the line of dunes mentioned above, leaving the more southern region dry. Such is, unhappily, the general history of the arid lands abandoned each year by the lake.



SKETCH MAP
lustrate the Explorations of
E. LENFANT & M. A. CHEVALIER
1902-1904.

The surface of the basin is broken at wide intervals by blocks of red granitoid rock and quartz porphyry, which must once have been reefs in the lake-waters. Towards the Kebbi the formation is a detritus composed of mica and gneiss, while between this river and the Tuburi there are barriers of volcanic blocks arranged in lines from north to south. From the lake to the Tuburi the rise of level is imperceptible, but from the latter the ground falls to the Kebbi, which must once have formed a branch of the ancient system of submarine depressions.

The drainage of this part of the African plateau recalls that of the lakes of the Timbuktu region, but whereas in the case of the Niger the descent by the Bussa rapids is spread over some 60 miles, in the case of the Kebbi the drop is compressed into the space occupied by the cataract and associated rapids at Lata.

The principal artery of the Chad basin is the Shari, but the Logone is the more active river. The Shari attains in places a vast width, with a considerable depth; in 1903 its summer rise amounted to 24 feet, while that of the Logone reached 16½ feet, the current of the latter being much more powerful. About the 10th parallel its waters spread over the plains, and some of them reach the Tuburi, there being no line of hills on the west bank, as some had supposed, to bar their access to this lake. Lower down it inundates the Kotoko region, some of the water finding its way to the Chad by the Bahr Afade and the Bahr Ngala, while the rest swells the Shari at the junction of the two streams in the latitude of Manjafa. The Tuburi, which is connected with the Logone by a small river, navigable at high water only, is a wide and deep lake, forming a hook-shaped loop towards the south, which is prolonged towards the Kebbi by an impetuous torrent which winds among the volcanic masses of which mention was made above.

Lake Chad can no longer be regarded as a vast inland sea, affording the means of brisk commercial activity between its shores. Year by year evaporation restricts its limits, and on the borders of Kanem, on the east, the islands seen by Overweg have become *terra firma*, while the sandbanks spoken of by him have been transformed into islands, and the masses of floating herbage are in their turn taking the form of sandbanks. Thus the traveller who stands on the old lake-shore has before him three zones of islets in course of formation, ranged in regular lines and separated by channels, sometimes of great depth, and maintaining a uniform direction. A similar phenomenon is to be noticed in the north, while in the south there are wide, grass-covered banks broken by small expanses of open water, and the town of Ngornu, found by Barth in course of re-establishment after an inundation by the lake, is now at a distance of 20 miles from the shore. In the extreme east the Bahr-el-Ghazal is no longer connected with the lake, the intervening stretch having become a millet-field of great fertility, thanks to the rich alluvium left by the waters.

It is quite intelligible that in a region of such imperceptible slope as the Chad basin, enormous areas may be withdrawn for ever from the fertilizing effects of the inundation as a result of several consecutive years of drought. The lake has an annual rise, due to that of the Shari and to the waters derived from the Kotoko and Musgu countries; and, singular as it may seem, this rise takes place in the dry season, towards December, reaching its maximum of about 23½ inches in the middle of January, when there has been time for the region to the south to have been thoroughly drained of its surplus water. But inasmuch as the amount of water received is less than that lost by evaporation and percolation, while the rainfall is also diminishing, the absolute level sinks progressively, although the difference between high and low water remains constant. With the retreat of the lake into its deeper and more restricted basin, the loss will become proportionally less, and a condition of equilibrium will in course of time be set up. The lake no longer retains its heart-shaped form shown on our older maps,* but has rather that of a kidney bean. It measures some 125 miles by 40, but in spite of its smaller area the north-east winds still raise a heavy swell at times.

To return to the course of the expedition. The Kebbi—which from its exit from the Tuburi takes a south-westerly direction, afterwards expanding into the lakes of Treme and Lere, and flowing on to Bipare by a multitude of sharp bends—was found to carry a considerable volume of water, the depth never falling below 6 feet, until in the neighbourhood of Lata, where the one obstruction to navigation occurs. There is here a fall of 165 feet, preceded by rapids, though below the fall the river is quite placid. The difficulties are increased by the precipitous walls of rock on either side. It was necessary to take the *Benoit-Garnier* in pieces at Bindere Mundang and transport it to Sulkano, a distance of 20 miles, which was at last accomplished in spite of difficulties with the natives. At Mburao, amid the mud and miasmatic swamps of the Tuburi, it was again put together, and on October 17—the water still rising—a start was made in search of the hoped-for connection with the Logone, on which the practicability of the route so much depended. A grassy plain without a single elevation extended to the north-north-east, across which the party struggled for five days in stifling heat, the boat constantly sticking fast in the mud. But on the 28th a small river was found which traversed a series of pools and led to a wide and deep marsh covered with water-plants, in which the current of the Logone was at last perceptible. The latter stream was entered and descended to Fort Lamy, the journey being continued to Lake Chad after a stay of ten days at that post. The expedition broke up into three parties, one of which made the circuit of the lake in the *Benoit-Garnier*, while the other two examined the country to the east and west, collecting the information on the geography of the region, the salient points of which have been summarized above.

Captain Lenfant expresses a very unfavourable opinion of the part of Bornu with which he became acquainted, which is, he says, but little populated or cultivated, while it is threatened with progressive aridity by reason of the frequent failure of the rains. Game is also scarce here, while in the French territory on the right bank of the Shari it is very abundant. The extreme south of Bornu comprising the clay formation once covered by Lake Chad, is still poorer. It is only in the Fulbe country, from Belda to the Mayo Kebbi, and from Mandara to the Musgu, that prosperity is once more seen.

In comparing the Chad region with that of the middle Niger, of which he has a high opinion, Captain Lenfant comes to a conclusion decidedly unfavourable to the former. The districts at present occupied by France may be divided into two groups, the first called by Captain Lenfant the Kebbi colony, including the Mundang country and neighbouring districts on the Logone and Tuburi; the second stretching from the Shari to Wadai, and from Kanem to Bagirmi. The first is rich, fertile, and well peopled, while the second is practically valueless. It is, therefore, on the first region that the principal efforts at development should be directed. One of the most important districts is that around the Fulbe settlement of Bindere, of the richness of which the explorer speaks in glowing terms. He was delighted with the aspect of the country at the season of harvest, and even when the crops were gathered in, the pastures with their fine herds of cattle and numbers of horses; the shade afforded by the rubber, gum, and *karite* trees; the villages with their granaries and active industries of weaving, dyeing, tanning, etc., gave an equally pleasing impression. This centre, formerly shown as on the German side of the boundary, was proved by an observation of Captain Lenfant's to lie in 9° 57′ 59″, or within French territory, and friendly relations were established with the *lamido*, or king, Bokari by name, who is almost white, exceedingly intelligent, and an honour to the Fulbe race. The cultivation of cotton is particularly active in this district, and great care is taken in the selection of varieties, the dates of sowing and gathering, the methods of weaving and the designs employed; the samples of stuffs obtained here being especially fine. This native cotton is worthy of special attention on the part of Europeans, who may find here a valuable object-lesson in their efforts towards the development of this field.

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* It should be remembered, however, that in giving it this form the earlier explorers were indicating the maximum extent at the height of its flood, and fully recognized that even at that date the area was very much more restricted during low water. —[Ed. *G.J.*]

The water-route investigated by Captain Lenfant and his companions will form, during several months in the year, an excellent means of replenishing supplies and exporting the productions of the country. When the transport system is properly organized, about eighty days will suffice to reach Fort Lamy from Bordeaux in place of the five months required by the Congo and Ubangi.

The second expedition, that of M. A. Chevalier, has been still more productive of geographical results, as it was considerably longer in the field, and covered a larger area of previously unvisited ground. It has likewise contributed not a little, thanks to the scientific attainments of the leader and his assistants, to a better knowledge of the natural productions of the regions traversed. M. Chevalier, who had already made his *début* as an African traveller under the auspices of General Trentinian, succeeded in interesting in his project for a more extended journey such influential personages as M. Gentil, M. Binger, Dr. Hamy, and others, and likewise obtained the countenance and support of various public departments. After two years' preparation, the arrangements were finally completed in April, 1902, and by July 17 of that year the party was united at Brazzaville, whence the voyage to Bangi was accomplished by steamer.

M. Chevalier describes the transition from the grass-lands subject to annual burning, where two shrubby species of *Landolphia* form the chief economic resource, to the equatorial forest, with its more varied products of cola, coffee, vanilla, copal, in addition to rubber-vines and the one important rubber-yielding tree, the *Funtumia elastica*, which is indigenous to the African continent. In spite of its latent wealth, this forest region has not yet yielded results commensurate with its promise, and the Bonjo race which inhabits it—which, though much given to cannibalism, was, like the Niam-Niams, possessed of a considerable degree of indigenous civilization—is at present, owing to the force of circumstances, one of the most wretched of African peoples. The transport system on the upper Ubangi is still in a rudimentary state, and its navigation was a matter of much difficulty. At Krebeje or Fort Sibut, on the Tomi, an experimental garden was formed, and plants and seeds of fruit trees, and other useful plants which had been taken out from France, were at once placed in the ground, to the number of 460 species. After preliminary studies in the Banda countries, the leader set out on November 11, accompanied by M. Courtet, for the states of Sultan Snussi. The passage from the basin of the Ubangi to that of the Shari takes place across a district now completely uninhabited, though a few years ago it possessed populous villages; among the causes mentioned for this state of things being (in addition to famine, the attacks of the Bandas, and the like) the flight of the people to avoid the enforcement of porterage. The cannibal Manjias—whose habitat begins at the water-parting—are, like the Bonjos, in a state of great misery, though formerly possessed of a fair amount of civilization. They are grouped into a number of patriarchal clans, and seem to have originally come from the west, while the Bandas had their home further east. Both races dwell side by side at Fort Crampel, the nearest French post to Ndelle, the capital of Sultan Snussi.

To reach the latter, twelve marches have to be made through a country almost uninhabited on account of slave-raids. The sultan received the travellers with great cordiality, and gave them every facility for their researches, himself supplying much information on the geography of the surrounding region, which, during his many journeys through Dar Fertit ("Country of Savages"), he has learnt to know thoroughly. It was by guides supplied by him that the travellers were taken to the elevated region at the junction of the Congo, Shari, and Nile basins, where a new species of wild coffee, named by M. Chevalier *Coffea excelsa*, was seen growing. The tree reaches a height of 50 or 60 feet, and its produce—which has an exquisite aroma—has long been known to the Arabs, a small quantity finding its way each year to Wadai. Twenty years ago it was seen by M. Rivière in the markets of Tripoli.

After some hesitation, Snussi gave permission for the travellers to visit the Mamun marshes, which they had heard spoken of as an inland sea comparable to Lake Chad, but which they found to their disappointment to be nothing but a marshy plain, some 100 miles long, in which the five rivers Tete, Mosuburta, Bungul, Minjia, and Kumara converge. Of these only the Minjia had been previously reached by a European (Potagos), and that near its source. The name Mamun is given in particular to a lagoon 2½ miles long and 80 yards wide, inhabited by hippopotami and situated in the centre of a tract which must be in great measure covered by water at the close of the rainy season. This region, inhabited by the Golla Home, is the counterpart of the more westerly marshy districts lying between the middle Shari and the Mayo Kebbi. Its great bare plains, with their unproductive clay soil, abound with game of all kinds. The rivers contain several huge kinds of fish, including the *Lates Niloticus*, and the stagnant waters are the home of two strange fish—the *Protopterus*, called *Abkur* by the Arabs, which, when the marshes dry up, encloses itself in a cocoon and remains for several months without a drop of water; and the *Malopterurus*, which gives a violent electric shock to those who touch it. The marshes are likewise infested by the *Bojene*, a fly of the genus *Glossina*, which, like its congener the tsetse, proves very fatal to horses and cattle. The return to Ndelle was made through a corner of Dar Runga, and a visit was also paid to the curious sandstone *massif* of Kuti, seamed with deep gorges whose streams flow in cascades under the shade of oil-palms.

At Ndelle the first rains occurred at the end of March, and the ground was soon covered with a green carpet of turf interspersed with gay flowers. A first essay in the cultivation of rice on a large scale was made by the sultan's women, and a month later a successful harvest resulted from an experiment with Arab wheat, while the plantations of other crops covered a yearly increasing area. The sultan has also made efforts to acclimatize cattle and horses, which he has brought each year from Wadai, and under his auspices commerce is steadily increasing; a part of the products being exported through the French factory, a part through Wadai and Darfur. Much is to be hoped from the enlightened efforts of this remarkable man in the path of peaceful progress.

M. Chevalier left Ndelle on May 2, and reached Fort Archambault on the Shari twenty days later by way of the Bangoran valley. Dr. Decorse, who had previously remained behind on account of ill health, had been there more than two months, and had brought together most valuable ethnographic and zoological collections. The district around Fort Archambault is the habitat of the Sara race, who quite bear out the statements of Maistre in regard to their exceptionally fine physique, some being quite herculean in stature. They show a surprising vitality in the midst of populations apparently in course of extinction, and, being mild and peaceable in disposition, and industrious agriculturists, are one of the most promising of all African races. They possess a hardy breed of small horses. Their country, with its thriving fields shaded by fine trees, recalls the fertile belt of the Western Sudan, of which all the characteristic trees except the baobab are represented. The people, too, show many resemblances with the Mande race. East of the Shari the type of the country and people changes in proportion as we proceed towards Wadai. The first river met with is the Bahr Keita or Auk, which represents the Bungul combined with all the streams of the Mamun plain and Jangara. It is but a small stream, nearly dry in the dry season, for in this zone of low-lying plains much of the water is absorbed by the swamps and old sand-obstructed channels, so that the streams are much more powerful in their upper than in their lower course. The Bahr-Salamat, a little further north (the only river of Wadai which brings any water to the Shari), is dry during a large part of the year, being, in fact, merely a *wadi* 200 yards wide in the neighbourhood of Lake Iro, with banks 16 feet high cut in the clay, between which water flows for four or five months only. From Dar Runga to its junction with the Shari, it flows through a bare plain of impermeable clay, full of crevasses and depressions in which the water collects during the rains. The largest basin is Lake Iro, which only measures 11 miles by 5½, including a wide grassy margin flooded yearly. The natives of the country round the lake belong to the Kulfe or Gulla stock, forming a dozen or so of tribes, each independent of the others. Their villages are built on small rising grounds above the limit of the inundations, and are generally fortified, like those of the Ndukas of the Bangoran, by one or several fences of spiny shrubs, in the midst of which are the circular clay huts, with such narrow entrances that the occupiers have to crawl in like a cat. This seems to be for the sake of protection against wild animals, which come in great numbers during the dry season to drink at the lake. The inundations last six months, and the people then move about at ease through the mud and water. Their legs are abnormally long for the size of their bodies, and, were it not that they appear to be nearly related to Kabas and Eastern Saras, might be taken for a special race of amphibious beings. The last-mentioned tribe, which dwells south of the Bahr-Salamat and has no connection with the Western Saras, consists of three great families, the Jinges, the Ngakes, and the Mbangas. They are of robust physique, but have been much impoverished by the raids of their neighbours. The women disfigure themselves frightfully by the objects which they insert in their ears, noses, and lips, the wooden discs introduced into the lower lip being sometimes as large as a small plate.

North of the Salamat dwell the Buas, Sokoros, and the Nubas or Fagnias, the last dwelling in minute beehive huts perched on almost inaccessible rocks, while they flee in case of attack into caves hidden in the cliffs. From the granite ridges of the Niellims, a dreary plain of impervious clay, with thorn scrub and dum-palms, and occasional grassy depressions inundated during the rains, stretches away into the heart of Wadai. Ancient watercourses, now in great part choked in the sand and known as "minias," are often met with, while "batas" are watercourses in which there is an annual flow of water during one or several weeks. Such is the Bata Lairi, which formerly carried the overflow of the Salamat and Bahr-el-Abiad to the Bahr-el-Ghazal and lower Shari, and which still conveys some of the flood-water of the middle Shari to the neighbourhood of Lake Fittri; though it does not now reach the site of Lake Baro, which has been dry for several centuries. The whole country, which forms part of the belt of impermeable clay stretching from the middle Niger to the Nile, must once have been traversed, like the Netherlands, by an interlacing network of channels, and the greater part of Bagirmi is composed of similar country. East and south-east of the Lairi, the granite eminences of the Nubas emerge from the scrub-covered plain in the form of sugarloaf peaks or elongated escarpments, the immediate vicinity of which consists of sandy ground capable of cultivation. The Gueres mountains, which M. Chevalier was unable to visit, are a vast pile of rocks forming a high plateau watered by a perennial river, though Barth was mistaken in believing that frost and snow are known here. The plateau is inhabited by the Kengas, a pagan tribe.

In Southern Bagirmi Mohammedan colonies are met with from the tenth parallel northward. In this part of the country the flow of water in the rivers is very uncertain, and cannot be counted on for regular navigation. In the loop of the Shari known as the Bahr Ergig or Ba-Mbassa ("little river"), which was well filled for several weeks in 1897, no continuous flow seems to have been established either in 1902 or 1903, though in the latter year the level of the flood in the main Shari was considerably above the average of the preceding years. The capital of Bagirmi, since the destruction of Massenya, has been at Chekna, on the banks of the Ba-Mbassa, but when the bed of this is dry, viz. from March to October, the town is almost without drinkable water, and it presents a miserable appearance, its trade being quite insignificant. Most of the goods sold are of English origin, coming chiefly from Yola, on the Benue. A small amount comes from Khartum through Wadai, but the trade across the Sahara through Kanem has entirely ceased during the last few years. Massenya is now nothing but a heap of ruins already beginning to be choked by vegetation. The Sultan Gaurang, who received the expedition most cordially, is, like Snussi, one of the great personages of present-day Africa, but much time will be needed before Bagirmi can, under the philanthropic tutelage of France, recover its former prosperity. There now remain only some 100,000 inhabitants out of the million at which Barth estimated the population, but the country still retains elements of well-being which give hope for the future, though the whole northern part of the kingdom, belonging to the clay zone already described, is exceedingly poor.

Like Captain Lenfant, M. Chevalier saw many signs of a much greater extension of the water system of this part of Africa. He is inclined to believe that once a great river, of which Lake Chad was only a backwater, flowed north across the Sahara to the Mediterranean, and that the abundant relics of the Neolithic age found throughout Northern Wadai and the districts adjoining the Bahr-el-Ghazal are indications that a prosperous community once lived on its banks. The vegetable and animal remains met with in the countries traversed afforded countless proofs of a progressive desiccation, and the invasion of the Sudan by a Saharan climate. But the process does not progress regularly, for as a result of several consecutive years of abundant rainfall, Lake Chad has at various times spread beyond its usual bed, flooding large areas and taking several years to retreat within it again. There is a native tradition of a deluge which once destroyed all the peoples of Central Africa, and this has been modified by the Arabs, who hold that Noah came this way during the flood, and that his ark afterwards struck ground on the rocks of Ajer-el-Amis. In 1870 the lake rose to an exceptional height, and again in 1897 a rise took place, but since this date the waters have continued to fall. The greater part of the water-channels which remain will probably dry up in the course of a few centuries. A similar fate has already overtaken other lakes; *e.g.*, as a result of the drought in 1902, Lake Fittri had completely dried up in

1903, and the hippopotami and certain of the fish which inhabited it have left it never to return. Kanem is likewise a dried-up country, and no illusion should be cherished regarding its value.

Summing up, M. Chevalier holds that, in spite of the present ruin brought about by slave raids, the Central Sudan possesses resources which will give it a value when the policy of peaceful development has borne fruit. Like the whole belt of country from the Atlantic to the Nile, it may be divided into three zones, each with its own proper products, the intermediate one being the best peopled and the home of the most flourishing agriculture. Like Captain Lenfant, M. Chevalier foresees a great future for the systematic cultivation of cotton in this region.

REVIEWS.

EUROPE.

COMMERCIAL GEOGRAPHY OF GERMANY.

'Handbuch der Wirtschaftskunde Deutschlands. Herausgegeben im Auftrage des deutschen Verbandes für das kaufmännische Unterrichtswesen.' Dritter Band. Die Hauptindustrien Deutschlands.' Leipzig: 1904.

THE issue of the third volume of this compilation marks an important step towards the completion of the original design of those responsible for the inception of the work. It is now possible to take a general view of the whole, and to estimate the relative importance of the various elements. The intention is to give a description of the economic life of Germany, which shall have a certain completeness and independence, and be sufficient to meet the requirements of the more advanced student of industry and commerce in the preparation for the active life of business. The only general scientific basis for a work of this type is geography in the broadest sense; accordingly, the first volume is entirely devoted to the general geographical description of Germany. In its method it is a protest against the old-fashioned plan of enumerating facts without any attempt at explanation. The well-equipped man of business must be acquainted, not merely with the phenomenon, but also with the cause. The volume deals first with the broad physical divisions of the country, and the geological formation, with especial attention to such questions as the distribution of useful minerals. Climatic conditions are treated more particularly in the light of their influence on industry and economic life. The section is completed by an account of the useful animals, tame and wild, the fisheries, and the character and distribution of the population. The method of treatment is determined by the object of the work. Attention is necessarily devoted to the economic rather than the physiographical aspect, the consequences rather than the causes of the phenomena described. This is especially noteworthy in the section on climate, in which considerable space is given to the discussion of the influence of temperature, rainfall, and sunshine on the growth of organic life, the mortality of the population, and the organization of industry. The chapters on useful plants necessarily partake rather of the character of enumeration, though in the matter of thoroughness the enumeration leaves little to be desired.

The second volume deals in detail with the agricultural, pastoral, and forest industries of Germany. The various sections are prefaced by brief historical monographs, and treat systematically of the distribution and interconnection of the various industries, the disposal of the products, cost of transport, and character of the markets. The geographical element is not neglected, but its scope is smaller than in the earlier part of the work. The third volume tends to be even more technical. It deals elaborately with industrial organization under the divisions of the different trades and occupations. It contains a mass of statistical and other information which we are accustomed to find in official reports and trade papers of a technical character. There are sections on the distribution and sources of raw material of various industries, but on the whole the geographical aspects of the subject tend to disappear in the technical. This can scarcely be avoided, in view of the very miscellaneous character of the subject-matter included in the volume. Its main value is as a book of reference on special points, a value greatly enhanced by the bibliographies attached to each section. To the student of geography, the earlier volumes, with their numerous special maps, and interesting deductions, based on the laws of natural phenomena, will provide the greater attraction. The series will be completed, in so far as Germany is concerned, by the promised fourth volume, dealing generally with the conditions of transport and foreign trade.

A. J. S.

ASIA.

AN EXPEDITION TO K_2.

'Six Mois dans l'Himalaya.' By Dr. J. Jacot Guillarmod. W. Sandoz: Neuchâtel. 1904. Pp. 363. *With Three Maps.*

In 1902, a party, consisting of Messrs. Eckenstein, Knowles, Crowley, Pfannl, Wessely, and the author of this book, spent eight months on a journey to peak K_2. A series of misfortunes prevented them from an attempt to reach the summit of the mountain, but a height of 22,000 feet was attained. The route followed from Rawal Pindi struck north-east into the valley of the Jhelam and to Srinagar, thence by the Sind and Dras valleys into that of the upper Indus, to Skardu, thence to Askole, and so up the Baltoro glacier. On the return journey a more direct route was followed between Skardu and Srinagar. The party arrived at a high altitude successfully, and established camps on Godwin-Austin glacier at successive altitudes from 16,592 feet to 21,000 feet. On July 10 Messrs. Guillarmod and Wessely attained an altitude, on one of the spurs of K_2, of 22,000 feet, and had every expectation that a further attempt would carry them higher still. After this, however, bad weather set in, one of the party fell seriously ill, and none retained perfect health; while the decision to return, greatly to Dr. Guillarmod's disappointment, was arrived at when news came of an outbreak of cholera in a part of the country through which the homeward journey lay.

The book, which gains greatly, as all descriptive work does, from the use of the French language, is interesting reading, describing the whole journey from Europe in detail, and the object of the journey apart, providing a foreign traveller's impressions of a part of the British Empire, such as are always acceptable and, in a general way, instructive. The primary object of the expedition was not scientific, and the few scientific notes are almost entirely confined to a short appendix. Some, however, are noteworthy. Prof. Suess had desired Herr Pfannl to watch for the occurrence of sedimentary deposits of periods anterior to the great folding which raised the Himalaya as it now appears, and a little below the junction of Godwin-Austen glacier with the Baltoro, at an elevation of about 15,000 feet, the existence of such deposits was confirmed. The Balti porters accompanying the expedition were found to be unanimous in furnishing certain names of the northern tributary glaciers of the Baltoro which did not agree with those of Sir W. M. Conway's map. A certain amount of botanical work was carried out, and the highest limit of vegetation was found at about 17,400 feet (5300 metres). A table is furnished of daily maxima and minima of temperature from May 29 to August

12 (*i.e.* from Askole upwards and back), the highest and lowest recorded at Camp XI. (20,000 feet) being respectively 35° and −19° Cent. Excellent maps illustrate the journey, one showing the Baltoro and tributary glaciers on a scale of 1 : 200,000. Finally, Dr. Guillarmod is to be congratulated upon a really magnificent series of photographs. There are no fewer than 269 in the text; some of them are too small, and the reproduction is not always perfect, but any deficiencies in these find compensation in the ten beautiful photogravures, which are beyond praise.

O. J. R. H.

CHINA.

'The Back Blocks of China.' By R. Logan Jack. London: Edward Arnold. 1904.

In 'The Back Blocks of China' Dr. R. Logan Jack describes a journey undertaken by the author and his son at the instance of the Chinese Government to examine the mining capabilities of Western China, an account of which was read to the Society on January 13, 1902. After travelling from Shanghai to Cheng-tu, expeditions were made to the north of the province, and to mines in the nearer neighbourhood of the capital. Then, journeying to the south-west of the province, a stay of some weeks was made at Maba, a gold district to the north-west of Ning Yuan Fu, but the outbreak of the Boxer troubles in China made it necessary for the party to leave the country, and after a vain attempt to reach Assam through North-West Yunnan, they struck south into Burmah. On leaving Maha, it took them over thirty days to travel 370 miles, so great were the physical obstacles in the shape of rivers and mountains which had to be overcome. But the journey led to the discovery of an enormous bend in the Yalung river, a great tributary of the Yangtse, similar in contour to that, but a short time previously discovered in the Yangtse itself by M. Bonin. Additions were also made to our knowledge of the country south of the Yalung's bend, as well as of Western Yunnan. But as Captain Ryder, with Major Davies and Colonel Manifold, was at the time traversing the province in all directions, it is difficult to say who was the first to break untrodden ground.

Dr. Jack gives no information as to the result of his inquiries, nor as to his views regarding the future of mining enterprise in Western China. At Maha, where he spent nearly a month, the quartz mine had been worked for twenty years, and machinery had been set up, each piece of which had been carried there on men's backs. Notes on the geology of the country as far west as Maha are sprinkled through the earlier chapters, but there is less information regarding that of North Yunnan.

The numerous styles of bridge-building attract much attention from the author, and are described with much enthusiasm, as are also the great irrigation works round Chengtu, the capital of Szechuen.

W. R. C.

A FRAGMENT OF KAMCHATKA.

'A Shooting Trip to Kamchatka.' By E. Demidoff, Prince San Donato. London: Rowland Ward. 1904. Pp. xvi., 302. *With Two Maps.*

Though in no way a scientific study of Kamchatka, this is much more than a mere record of sport. Even if it were not, the book would be of value in a geographical library simply for the photogravures and photographs, which number over a hundred—several showing country never before visited unless by natives—and are admirably reproduced. But, as a matter of fact, sport takes a secondary position in the work; for, speaking by the book, it was not remarkably successful, and the time devoted to it, owing to the length of the journey, was of the briefest.

The work, therefore, becomes a highly interesting record of an interesting journey, detailed from the moment of entering upon the Trans-Siberian railway. In this event the first chapter is very happily inserted, for it outlines the history of Kamchatka from the end of the seventeenth century, when a merchant named Alexeieff, who went to an unknown fate, gains the uncertain honour of being the first Russian to enter the peninsula. The part of the country where the author broke new ground lies at the source of the Kamchatka river, which is some 230 miles in a direct line north-east by north of Cape Lopatka, the southernmost extremity of the peninsula in 54° N., 159° W. Its tiny headstream falls immediately into a lake about 2 miles long by three-quarters of a mile wide. (On the large-scale map accompanying the volume it appears as about 9 miles by 4.) Snow-clad hills rise abruptly from it, and its altitude is 3500 feet. It was named Lake Sofka Demidoff, after the author's wife, who accompanied him, together with Mr. St. G. Littledale. Travelling was found very difficult in parts, whether owing to swamp or to belts of rhododendron bush. Mosquitoes were a scourge. As regards climate, snow lay deep in the interior in June; fog is the constant accompaniment of the southerly winds, storms of the north-easterly. The first are prevalent in June and July, which are usually the dampest months in Kamchatka. By July 15 autumn was rapidly approaching. The wild sheep, *Ovis nivicola*, was the object of the sportsman; but bears were also plentiful. Salmon were running up the rivers in countless thousands. It is of interest to note that civilized lures failed against them, though large sea-trout were taken on the spoon. Both are netted and trapped by the natives, and form a valuable article of commerce. On the whole, Prince Demidoff has made excellent use of his visit to what is only a tiny section of this vast peninsula, and the book is a fitting successor to his similar works on the Caucasus and the Altai.

O. J. R. H.

AFRICA.

THE JESUITS IN ABYSSINIA.

Camillo Beccari, S.J. 'Notizia e Saggi di opere e documenti inediti riguardanti la Storia di Etiopia durante i secoli XVI., XVII. e XVIII.' Rome: Casa Editrico Italiana. 1903.

This is intended to serve as an introductory volume to a series of reprints of important documents relating to the history of Abyssinia and the work of the Jesuit missionaries in that country during the sixteenth, seventeenth, and eighteenth centuries. Circumstances, not altogether easy to explain, have brought it about that few of the early records, coming from the pens of European writers, have ever appeared in print. Thus of the two earliest and most authentic records—the works of Paez and D'Almeida—although D'Almeida's work has long been known from the manuscript in the British Museum, the very existence in modern times of any such version of the work of the former has been doubted by many writers. But Father Beccari's researches in the archives of Italy and elsewhere have yielded valuable results, in the discovery not only of Paez's original manuscript, but of many other documents bearing on the history of the Jesuit work in Abyssinia, the publication of which will throw light on many points hitherto obscure.

The present volume consists of three parts; the first giving a full list of the documents in question, which include a large number of letters written by the missionaries or their superiors in Europe; the second sketching their contents; and the third reproducing passages from the more important, with an Italian translation by the side. It is with the portions bearing on the geographical discoveries of the Jesuits that we are here principally concerned, and it is this side of their work which is likewise dealt with in the more important extracts printed. The full text of the documents is to appear in subsequent issues.

The discovery of Paez's manuscript is of special interest from the fact that it contains the first detailed account of the sources of the Blue Nile, the visit to which of that missionary was so unjustifiably descredited by Bruce. Father Beccari is, not unnaturally, very severe on the latter, maintaining that, in the light of our present knowledge, the famous traveller can only be held guilty of wilful falsehood. It is certainly difficult to reconcile his statements with the supposition of good faith, and there can be no doubt that in any case they were made with extreme carelessness, and with a view to belittle as much as possible the exploits of his predecessors. To begin with, his statement that he had inspected three copies of Paez's history is puzzling, inasmuch as the copy lately brought to light is the only one of which any other writer has been aware. But even if other copies existed in Bruce's time, it is still more strange that the traveller should have declared that Paez said not a word about the Nile sources, when the passages printed by Beccari contain not only a full description of the sources, but the expression of Paez' feelings of elation at beholding them himself. In Bruce's treatment of Kircher's version, Father Beccari sees equal evidence of bad faith, holding that it was only by suppressing important passages that he was able to make out a case against its veracity. But the charge can hardly be regarded as proven.

Father Beccari's discovery has also shown the inaccuracy of several of the conclusions drawn by such commentators as Cooley and Beke. The former appears to have assumed, no doubt owing to the Spanish nationality of the writer, that Paez's manuscript was originally written in Spanish, and this certainly seemed supported by D'Almeida's statements, quoted by Cooley, that he had translated portions of the work. But Father Beccari's find is in Portuguese, so that unless—which would seem to be negatived by its being, according to the editor, in Paez's handwriting—the manuscript is a translation from the original, D'Almeida would seem to mean only that he had incorporated parts of the earlier work. Again, Cooley's doubt that Kircher's version was genuine seems not justified, although, as the editor shows, the translation given by the latter is by no means accurate. A comparison of D'Almeida's description of the Nile sources (also printed in the present volume, together with a reproduction of his original sketch-map) with that of Paez, shows that the former did not draw wholly from the latter, but had probably visited the spot himself.

Of the other documents of which extracts are given, the most important are three treatises (one on the Kingdom of Tigre) without author's name, but which the editor shows to have been certainly by P. Emmanuele Barradas; and Alfonso Mendez's 'Expeditionis æthiopicæ Libri tres.' None of these have ever been printed. The editor discusses the reason for this apparent indifference on the part of those at home, and comes to the conclusion that the plain and unembellished language in which the works were written little suited the taste of the time, while, in the case of Mendez's history, the outspoken character of some of the remarks may have been an additional reason for keeping it unpublished.

E. H.

AMERICA.

CANADA.

'Canada in the Twentieth Century.' By A. G. Bradley. Westminster: A. Constable & Co. 1903.
'Through Canada in Harvest Time.' By James Lumsden. London: T. Fisher Unwin. 1903.

These two books are very different in their nature, but both have their value. The work of Mr. Bradley is that of a man who has made himself familiar with many parts of the Dominion by periods of residence and prolonged visits at intervals extending over the last thirty years, and has made excellent use of the opportunities he has had for observing Canadian life and industry, the conditions on which it depends, and the changes that have taken place in the period mentioned. Statistics are almost entirely omitted, but without their aid the author manages to draw a very vivid and interesting picture of both working and holiday life in town and country in those parts of the Dominion with which he is intimately acquainted—that is, all except the three eastern provinces of Nova Scotia, New Brunswick, and Prince Edward Island. Advice of the most practical kind is given for the benefit both of those who may think of visiting the Dominion either as sportsmen or tourists, and of intending settlers. In the description of the country the author shows due appreciation of the geographical features, and his intimate acquaintance with the history of Canada, shown in his previous works, enables him to introduce concise but adequate accounts of the stages in that history which are of most importance in throwing light on the present situation. In speaking of the geography of Canada, Mr. Bradley justly complains (pp. 143, 144) of the nearly uniform practice of drawing maps of the country in such a manner as "to obscure the most substantial and populous and wealthy part of Canada in the eyes of outsiders," devoting to the older Canada a solitary page "mainly filled by the wilderness portion, thereby crowding the home of four million busy fellow-citizens into a meagre strip in a corner perfectly useless for geographical identification." It is, however, to be regretted that Mr. Bradley has himself followed this bad example. The book, which has many excellent pictorial illustrations, is provided with only one map, a general map of the Dominion on such a scale that, for example, it gives no hint of the physical features which mark off on the north and west the limits of the Eastern Townships as interestingly described by the author on pp. 90–92. To this general account of Mr. Bradley's book it may be useful to add a few references to parts of it of special interest and importance. No father who is thinking of settling his son in Canada should omit to read chapter viii., which deals with emigration to the North-West, and very largely with "the young gentleman farmer." Among other passages, one may note the account of the characteristics of the French-Canadian on pp. 51, 52, 117; of the typical French holding and village in Quebec on pp. 67, 68, 82, 83; of the influence of the Roman Catholic Church in Quebec on pp. 31–33, 80, 81, 109, 110; of the distaste of the upper classes in Canada for the land, p. 145; of the original reclaiming of Ontario, pp. 123, 167, 168; of the differences between the climate of southern and northern Ontario, pp. 173, 220; of the range of the chinook winds, pp. 316, 326; his prognostications as to the future of the North-West, pp. 339, 340; his account of the salmon of the British Columbian rivers, pp. 335, 336; of irrigated fruit-farms in British Columbia, pp. 363–365; and of the Chinese in the same province, pp. 392–394. The index, it may be mentioned, is not in every case adequate as a means of reference.

Statistics are as characteristic of Mr. Lumsden's book as their absence is of that of Mr. Bradley. The author was one of a small journalistic party who travelled through Canada during the harvest of 1902, and who, to quote the preface, "by public bodies and private individuals were given such opportunities of spying the land, as, according to general testimony, had never before been accorded to any body of inquirers from the Old Country." The book is the outcome of this visit, and portions of it appeared in a series of articles in the *Leeds and Yorkshire Mercury* and the *Leeds Mercury Weekly Supplement*, and the text, to use once more the author's own words, "may be roughly described as a combination . . . of the writer's own impressions and matters of fact of a statistical nature supplied by the official departments of the various provinces." The book reflects the buoyant feeling that pervaded Canada during the second bounteous harvest after the bad harvest of 1900, a feeling which, the present reviewer can testify, remained as general and as strong during the harvest of 1903. Hardly any but the rosiest aspect is given to the development of the Canadian North-West. "With never-failing regularity showers fall in June, we are told" (p. 128). It is quite true that no rainfall station of the wheat-growing area of the Canadian North-West shows an entire lack of rain in June; but there are great variations from year to year in the amount, occasionally, it would appear, with disastrous results to the wheat-crop. Both Mr. Lumsden (p. 128) and Mr. Bradley (p. 280) refer to the long summer day as favouring in a peculiar manner the wheat-crops of the North-West. But it hardly needs to be pointed out that the days there are no longer than in England, not so long as in Scotland. The reference to this consideration in English books is in effect the inappropriate transference to England of a point of view proper to Ontario or the wheat area of the United States. Among the statistics of Mr. Lumsden's volume, none are perhaps more interesting than the estimates of the cost of growing wheat on Canadian prairie-land and conveying it to Liverpool given on pp. 119 and 164, 165. It is to be wished, however, that these estimates, which are given, so far as they relate to cropping, on the authority of Mr. Charles Young, president of the Winnipeg Grain Exchange, were a little more satisfactory—at least, in their statement. The whole cost to the farmer of a crop of wheat delivered at the nearest elevator is estimated at about $6 per acre, but from the details given it does not appear how much is taken into account in forming the estimate. Nothing seems to be put down for the value of the land with its improvements. The cost of the labour required for summer-fallowing, the importance of which in prairie-farming is duly emphasized by Mr. Lumsden, is indeed reckoned in, but it does not appear that anything is allowed for the fact that a consequence of this practice is that work is done on two acres, a crop reaped only from one. It is not clear that anything is allowed for the up-keep of horses and the interest on and wear and tear of agricultural implements. Finally, one has a difficulty in attaching any definite meaning to the average cost of haulage to the nearest elevator. This is probably the most variable factor of all. The elevators are all beside the railways, but wheat is sometimes grown upwards of 50 miles from a railway. It would have been more instructive to give an estimate of the cost of production where the conditions are most unfavourable under this head.

G. G. C.

MATHEMATICAL GEOGRAPHY.

NAVIGATION.

The Organized Science Series. 'Modern Navigation.' By William Hall. London: W. B. Clive. 1904. Price 6*s.* 6*d.*

Another book on navigation is perhaps something of a work of supererogation; all that can be taught on the science has been admirably said in such excellent old works as the manuals of Raper, Inman, Norie, and others. Still, a familiar subject may be more attractive, or more interesting, when presented in an unfamiliar form. Mr. W. Hall, in his 'Modern Navigation,' has produced a very complete little book, so handily arranged as to suit admirably the requirements of navigators, and it should prove a useful handbook to more advanced and detailed study. The author's theory that for navigational purposes five places of figures are sufficient, is obviously correct; it would seem that four would be sufficient in the working of some problems. The graphic methods of solution add much to the interest of the book.

The book is a contribution to the Organized Science Series, published by the University International Press, Ltd., and edited by Dr. William Briggs.

D. W.-B.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

DISTRIBUTION OF PLANT ASSOCIATIONS.

'Plant-geography upon a physiological basis.' By Dr. A. F. W. Schimper. Translated from the German by W. R. Fischer. Revised and edited by P. Groom and T. B. Balfour. Oxford: The Clarendon Press. 1904. Pp. xxx. 839. 1 *Photogravure Portrait*, 5 *Collotypes*, 4 *Maps*, *and* 497 *other Illustrations*.

In the year 1898 there was published in Germany a book by A. F. W. Schimper, dealing with the distribution of plants mainly from a physiological point of view.

Hitherto generally, though not entirely, the distribution of the *plant species* had been the subject of study on the part of the phytogeographer. Schimper devotes only a small portion of his great work to the distribution of plant species. It is, on the contrary, concerned chiefly with the distribution of *plant formations*.

Most green land-plants are of sedentary habits, during the stages of vegetative growth, and they are therefore unable to move in search of the raw food-material and the energy which they require for the building up of organic food from inorganic raw material. This energy the green plant derives directly from the sun's rays. The raw material is, with the exception of the carbon derived from the air, supplied to the living cells of the plant by a current of water which is continually entering the plant by its root, charged with salts dissolved from the soil. After passing through the plant, this current of water is as continually leaving the leaf by transpiration, but not before all the salts brought up from the soil have been deposited in some green part of the plant. This current of water—the transpiration-stream—must be kept up. No process going on in the plant is so readily influenced by external conditions as this very transpiration-stream. In order, therefore, to carry out this process, the plant body adapts itself in form and structure to all those external conditions, which have an influence, adverse or otherwise, on the transpiration-stream. On the one hand, therefore, we have the external conditions, and on the other hand the plant functions. In between is the plant body, which in form and structure is the result of the influence of those conditions on the carrying out of one of the vital processes of the plant body—the transpiration-stream. A community of plants which are similar in form and structure, owing to their living under similar conditions, is known as a plant formation.

The presence of any particular formation is due, in the first place, to the annual rainfall—that is to say, to a climatic condition. A heavy annual rainfall gives us woodland, less grassland, and still less desert. These three forms of vegetation are known as climatic formations. But a certain climatic formation covering a large area may be interrupted by another kind of formation on account of some peculiarity in or of the soil. A river traversing grassland may produce, by its large supply of water, woodland on its banks. This woodland would be called an edaphic or local formation. It is the direct result of certain local conditions, namely, in this case the increase of water in the soil owing to the neighbourhood of the river.

We have now before us the completed English edition of Schimper's book, plant-geography upon a physiological basis, which, in the form of a text-book, contains a large number of observations by Schimper and numerous other biologists, which have some bearing on the influence of external conditions on plant-life.

Schimper at first enumerates and discusses those factors which in some way influence the production of definite plant formations, by affecting the carrying out of certain vital plant-functions. These factors are water, heat, light, air, soil, and animals. He then proceeds to describe the climatic or district, and edaphic or local formations, of each of which there are three types—woodland, grassland, desert. The third part of the book is devoted to the vegetation of the tropical, temperate, and arctic zones, and the regions of the mountain and water.

Schimper brings out three points very clearly in his book, which may be here quoted with advantage. "The type of *vegetation* in the tropical and temperate zones is determined by the amount and distribution of the *rainfall*, by the humidity of the air, and by the movements of the atmosphere, which essentially affect vegetation only by their desiccating influence." This refers to the plant formations.

Referring to the distribution of plant species, he says, "The type of the *flora*, in so far as it depends on existing factors, is dependent primarily on *heat*, especially if we consider, not the groups of lower order (genera and species), but those of higher order (cohorts, orders, and families)."

Lastly, "The differentiation of the world's vegetation is thus controlled by three factors—heat, atmospheric precipitation (including winds), soil."

The great importance to the geographer of this whole subject lies in the fact that the plant-formation is an expression of the influence of local conditions on plants, and it is thus a key to these conditions. From a study of the one we can draw conclusions as to the nature of the other. It is essential, for a proper description of scenery, that the traveller or explorer should have some knowledge of vegetation, as it forms such an important feature in nearly every landscape.

The book before us has been well translated and well published. Botanists and geographers owe the translator and the editors a debt of gratitude for the big task they have successfully mastered. The book is admirably illustrated. It is prefaced by an appreciation of the work of the author, whose premature and much-lamented death occurred in 1901.

O. V. D.

SIXTEENTH-CENTURY GEOGRAPHY.

'La Cosmographie avec l'espère et régime du Soleil et du Nord.' Par Jean Fonteneau dit Alphonse de Saintonge, Capitaine-pilote de François I^er^. Publiée et annotée par Georges Musset, Archiviste-paléographe, Correspondant du Ministère de l'Instruction publique et des Beaux-Arts. Paris: Ernest Leroux, 1904. (*Recueil de Voyages et de Documents pour servir à l'Histoire de la Geographie depuis le XIII^e^ jusqu'à la fin du XVI^e^ Siècle*, vol. xx.)

This last volume of an invaluable series will be found well-nigh as interesting as any of its predecessors. Its standard of scholarship and research is, perhaps, not as high as, for instance, that of Harrisse's 'Jean et Sebastian Cabot;' it appears to suffer occasionally from careless proof-reading; but it gives us a text of great value, with a useful introduction on the life of a fine old French sea-dog, and it is certain of a cordial welcome from all students of the history of exploration.

Alphonse de Saintonge, when he finished his *Cosmographie* in 1544, had, from his own account, already been a seaman and traveller for forty-eight years—in other words, since 1496. During this half-century he had navigated both in the French and Portuguese services; he had visited almost all the points of the African and East Indian shores especially frequented by the 'Lusitanians;' and his connection with Portugal was at times so close that some have made him a subject of Emanuel the Fortunate and John III. On the other hand, he appears, with Roberval and Cartier, as a pioneer of French exploration and settlement in Lower Canada. In Europe, Alphonse was best acquainted with the coasts of France and the Iberian peninsula; next, with those of South England; least, perhaps, with the shores of the North sea, the Baltic, and the Archipelago (though at least one voyage in all these waters must be credited to him). But Ireland and Scotland, probably, were quite outside his personal knowledge.

The African sea-front he had examined in great detail, both on its Atlantic and Indian sides. He appears to have journeyed extensively in the Red sea, to have circumnavigated Madagascar, and to have visited not only the chief East Indian islands and various parts of China, but perhaps the north-west extremity of Australia, if we may attach this meaning to his *Continental Java.* Beyond Sumatra (his *Taprobane*), he also speaks of an island, 300 leagues long and 100 broad, stretching away towards Magellan straits; but though we are greatly tempted to find here another suggestion of the Austral continent, it may be Borneo that is intended.

Alphonse's language about a region with three months' daylight may refer to Davis straits, into which he seems to have penetrated in a search for the north-west passage. As to the West Indies, our pilot appears to have had a fair knowledge of most of the islands and continental shore-lands; in fact, we shall probably not exaggerate in considering him to have acquired a practical acquaintance, from personal experience, with nearly the whole Atlantic littoral of North and South America, from Davis to Magellan straits. From other sources Saintonge appears as a pirate at Porto Rico; as a witness to the sale of a Rochelle vessel (April 18, 1537); as the leader of the reinforcements sent by Roberval to Cartier's Canadian enterprise; as an explorer and temporary settler in the Gulf of Saint Lawrence (1541–3); as a seaman navigating—with the occasional relief of a little piracy—among the West African islands, and especially the Madeira group (1543); and finally as a corsair who perished in a last fatal voyage against his old enemies of Spain.

Besides the *Cosmographie*, in which Alphonse gives us an account of all the coasts he had surveyed, and of all the seas and lands that he had known or heard of ('de toutes les provinces de l'universal monde'), he was the author of at least two, and possibly of five, other works, the chief of which is the famous 'Voyages aventureux,' in which a *periplus* is given us, first of the west and north European shores, from Denmark to the Straits of Gibraltar, then of the eastern coast of America, from Labrador and Newfoundland to Magellan straits, and finally of the East Indian islands, of the South Asiatic Littoral, and of portions of 'Cathay,' Egypt, Ethiopia, and Guinea.

As to the invention of the *jeanette*, which M. Musset claims for Alphonse, 'le créateur du mat, de la vergue, et de la voile de perroquet' (p. 19), this will perhaps not be conceded without dispute, but certainly a good case is made out by the editor for his 'Pilote Saintongeais,' celebrated in quaint verse by Melin de Saint Gelays—

> "Alfonse ayant suivi plus de vingt et vingt ans
> Par mille et mille mers l'un et l'autre Neptune,
> Et souvent défié l'une et l'autre fortune,

* * * * * *

Ore il tourne la voile à la faveur des vans,
En une heureuse route, à nul autre commune,
* * * * * *
Mais le *mas eslevé en signe de son nom*
Elevera tousjours dans le Ciel son renom. . . ."

C. Raymond Beazley.

THE MONTHLY RECORD.

EUROPE.

The Present State of European Limnology.—A painstaking and laborious compilation of all the results hitherto attained in Europe by the lake surveys of recent years has been made by Dr. W. Halbfass in the *Zeitschrift* of the Berlin Geographical Society (1903, Nos. 8, 9, 10; 1904, No. 3; also reprinted separately). The work will be useful both as bringing together into small compass a vast amount of *data* hitherto widely scattered, and as showing the exact state of our present knowledge of European lakes, and the gaps that remain to be filled before that knowledge can be in any way complete; for although a certain amount of limnological work may have escaped the author, there is little doubt that all the most important results have been included. The author divides the material according to countries, a subdivision into regions being made in the case of Germany before the final alphabetical arrangement of the lakes; and in the case of each of the latter the different elements (area, depth, volume, mean slope of sides, shore development, etc.) determined by the surveys are entered in tabular form. In all no fewer than 873 lakes are included, but the gaps in our knowledge are still very striking, especially as regards the lakes of northern Europe, though here there are already signs of improvement. The countries bordering on the Alps are the best known from a limnological point of view, though Sir John Murray's survey of British lakes will cause this country to take a high place. Many of the Alpine lakes require, however, more detailed examination. Spain is not rich in lakes, but a considerable amount of work awaits the doing, and the same is the case in Greece. On the other hand, the examination of the lakes of the more northern part of the Balkan peninsula is proceeding satisfactorily through the labours of Oestreich, Cvijić, etc. At the close of his paper, Dr. Halbfass groups together into five tables the lakes which stand at the head of the list in regard to certain special factors (depth, volume, etc.). Of 27 lakes which, so far as we yet know, attain a depth of 200 metres (656 feet) and over, 14 (including the four deepest) belong to the Scandinavian peninsula, 10 to the Alps or their borderlands, 2 to Scotland, 1 to Macedonia. All the deep lakes of Europe lie either on the margin of important mountain ranges or in regions of geological subsidences, and almost all the deepest occupy depressions reaching below sea-level. In Scotland and Norway many of the deepest lakes have their surfaces little above sea-level, and the difference between these and fjords is very slight. Of the high-level lakes (in regard to which much work still remains to be done), the deepest hitherto known seems to be the Lac Bleu in the Pyrenees (6457 feet above the sea), with a depth of 396 feet, but probably this may be exceeded in Norway. Both for volume and extent of shore-line, Onega takes the first place, the Scandinavian lakes Wener and Mälar following next, the first in respect of volume, the second of shore-line, while Mälar shows the greatest proportional development of shore-line of all the European lakes. For steepness of sides, the Königs-See takes the highest place, Loch Katrine the second, among lakes which exceed one square kilometre in area.

The Flora of the Swabian Alb.—In *Engler's Botanischen Jahrbüchern*, Bd. 32, Heft 4–5, Dr. Aug. Schulz criticizes Gradmann's work, 'Das Pflanzenleben der Schwäbischen Alb.' The latter author states that a fraction of the present flora consisting of the northern group of species extending southwards from the Arctic sea, has existed on the Alb from the second and most extensive epoch of glaciation. That many northern species have been almost interruptedly present on the Alb during the interval Dr. Schulz admits, but denies that this was due to successive propagation, holding that, though these species exist in climates as different as those of the glacial epoch and the succeeding milder interval, they would die out before they had time to adapt themselves to the change. Certainly those which had adapted themselves to the climate of the interglacial period following the second glaciation would not survive the third glacial epoch. Dr. Schulz also objects to the conclusion that woods were more abundant in the third great glacial epoch than in the second, based on the present distribution of plants indigenous to the upper alpine regions, which he maintains was very different at the period of glaciation. Nor does he consider it certain that all the species of the Alb flora belonging to the above group migrated from the Jura. Many also of Gradmann's pre-Alpine group probably found their way to the Alb at the same time. According to Gradmann, the third glacial epoch, during which large tracts of the Alb had a character similar to that of the tundras of the present day, was followed almost immediately by a period in which steppes were extensively developed. This view is combated by the author, who affirms that Nehring and other writers have drawn wrong conclusions from the arrangement of animal and vegetable remains in the deposits of Schweizersbild and elsewhere, conclusions that would be true only if it could be proved that remains never found their way from one set of beds to another. During the coldest part of the later cold period (by some called the fourth glacial epoch) the regions of Central Europe which were bare of ice, could not, he says, have resembled the tundras of north-eastern Russia and Siberia, but had a climate somewhat similar to that of the coastlands of south-western Greenland. An investigation of the development of the present flora of middle Europe shows that the coldest period of the last glacial epoch was followed by periods when the climate was temperate and sometimes even warm, before the climate of middle Europe assumed a thorough continental character. First conifers, especially *Picea excelsa*, spread themselves over a great part of Central Europe; then followed a time when the beech (*Fagus silvatica*) was the prevailing tree. Then the summers became again cooler and damper and the winters milder; and afterwards the quantity and frequency of the precipitation diminished and the temperature rose (the period of the *Ancyclus* subsidence in the Baltic), the climate becoming at length similar to that of south-eastern Russia at the present time, and steppes came into existence in Central Europe for the first time. Once more the climate became severe, the glaciers of the Alps increased to no inconsiderable extent, and alpine plants wandered into regions that had become suited to their existence. Dr. Schulz has much to say regarding the effects of these changes of climate on the distribution of plants, and his essay is of great interest to botanists.

Ethnological Research in the Færoes.—A paper by Mr. Nelson Annandale, reprinted from the *Proceedings* of the Royal Society of Edinburgh (vol. xxv. part i.), deals with the people of the Færoes. The first part deals wholly with the figures obtained by anthropometrical work on twenty subjects in Thorshavn, supplementing Dr. Förgensen's work, by which he was enabled to point out the difference between the inhabitants of Suderö and those of the northern isles. The second part is historical, and the combination of anthropometry with the scanty history and the traditions available leads to the conclusion that "the people, descended in the main from ancestors whose blood was somewhat mixed, but chiefly Norse, have remained more or less isolated for about a thousand years, except for casual immigration of persons and parties, who were probably 'Celtic' or Iberian, and who, it is safe to say, came either from Scotland, from Ireland, or from the intermediate isles." This admixture has, in particular, given their distinction to the inhabitants of Suderö.

The Bolshezemelsk Tundra.—This name is given to the north-eastern portion of the Government of Arkhangelsk, between the Pechora in the west, and the Ural and the Pai-hoi mountains in the east. It is but very imperfectly known, and therefore a sketch of its surface geology by N. Karakash, based on the recent explorations by A. N. Zhuravski, and previous research (*Bulletin* of the Society of Naturalists at St. Petersburg, 1904, No. 3), is worth noticing. This part of the tundra does not consist of immense borderless marshes as the western portions of the great tundra do, known as the Kanin and the Timansk tundras; its surface is all covered, on the contrary, with mounds and low ranges of hills, reaching 100, and occasionally up to 200 feet. Thus the Bolvanskaya Sopka runs east and south-east from the Cape of the same name, with an altitude of about 100 feet, for some 13 miles; the Mokhnataya Sopka runs to the east from Cape Mokhnatyi, or Sokolka, joining in the east the Yushinskaya Sopka, 200 feet high, which runs as a narrow ridge, or rather as an *ås*, or kame, southwards, to join another narrow ridge, or kame, the Ortinskaya Sopka, running east-north-east from the mouth of the Ortina river. It is only between these low ranges that one finds flat spaces covered with marshes, rivulets, numerous small lakes, and small separate hills, or rather mounds. Here and there one sees spaces covered with the dwarf birch, *Betula nana*, and willows. All these mounds, hills, and low ranges consist of a tough boulder clay of morainic origin, occasionally covered with sands. M. Zhuravski has made an interesting collection of the boulders with which the boulder clay is filled, and it appears that they consist chiefly of granites, porphyrites, amphibolites, gneisses, talc and chloritic slates, sandstones, limestones, and so on. Many of the latter contain fossils, which have been determined as belonging to the Devonian, Carboniferous, Carbo-Permian (or Artinsk), Permian, and Jurassic deposits, such as are found on the western slopes of the Urals. The Upper Carboniferous deposits which are found on the Urals are represented by the greatest number of fossiliferous boulders. The Permian and the Jurassic boulders may have been brought from the south, where both are found on the Pechora, or else they may have originated from deposits of that age which may have covered the tundra, and have been destroyed by the ice-sheet. All these mounds and ridges are undoubtedly moraines, which have been washed on their superficies by water. As to traces of marine deposits, they have only been found near to the sea; but it is known that further west, in the Timanskaya tundra, deposits of the post-Glacial sea have been found up to a height of 120 metres (360 feet), and that this sea covered large spaces, penetrating southwards up the Pinega and the northern Dvina. This post-Glacial extension of the sea has fully been proved by the researches of Tchernysheff, Stuckenberg, Hertzenstein, and Barbot-de-Marny, while Amalitskiy saw also traces of an inter-glacial period, which, however, would require more detailed exploration to be proved.

ASIA.

Physical History of the Issik-kul Region.—The journey in Russian Central Asia undertaken in 1903 by a party from the United States, including Mr.

R. Pumpelly, Prof. Ellsworth Huntington, and Prof. W. M. Davis, has already been referred to in the *Journal*. Prof. Davis returned to America after the first season's work, while Messrs. Pumpelly and Huntington have continued their investigations, and the latter has sent us a valuable paper on the anthropogeography of the region, which will in due course be printed in the *Journal*. Meanwhile Prof. Davis has given, in the *Bulletin* of the American Geographical Society (1904, No. 4), an outline of last year's journey, which contains some interesting observations on the physical history of the region traversed. With regard to the Issik-kul, he discusses both the peculiar relation which exists between the lake and the river Chu, and the geological changes to which the former seems to have owed its origin. The lake (as has been known from the work of modern Russian travellers,* though both Humboldt and Ritter were mistaken as to the facts of the case) has no outlet, the river Chu flowing past its western end, and discharging some of its water *into* the lake by the short river Kutemaldi. Prof. Davis thinks that the slight amount of salinity of the lake-water is an indication that the Chu was once both an inlet and outlet from Issik-kul, the change being brought about by the river itself, which seems to have built a fan delta, which led to a chance diversion of its course. Several abandoned shore-lines may be traced around the lake, and there are evidences of both positive and negative changes of level in the past. A drowning of the valleys which debouch into the lake is strongly marked at the eastern end, and this is in agreement with the report that ruins of houses are to be seen beneath the waters in this direction. The lake-basin seems in genetic contrast to the uplift of the mountain blocks to the north and south, which occurred long enough ago for the formation by valley erosion of stony Piedmont waste slopes, which are several miles wide on each side. The mountains, especially the Alexander range to the west of the lake, appear to be tilted and carved fault-blocks, such as have been described by Gilbert and Russell for the Great Basin of Utah and Nevada. In the present forms of the Alexander range, there are indications of fracture and uplift on the north, accompanied by tilting and relative depression on the south. In the basin formed by this depression much of the waste brought down by the upper Chu, which would otherwise have filled up the western end of the lake much more than at present, appears to have been deposited. In the steep walls and rapid fall of the channel of the Boam defile Prof. Davis sees evidence of the sub-recent uplift that the Tian Shan must have suffered hereabouts. *En route* for Semipalatinsk he crossed a fine example of an undissected peneplain, which he is inclined to think once continuous with the uplifted peneplain on the back slopes of the mountains round Issik-kul; the difference between the strong relief of the Tian-Shan and the monotony of the bordering steppes being due to the invasion of the former by forces of deformation and uplift, while the latter remained quiescent.

Expedition in Perak and the Siamese Malay States.—In 1901-2 Messrs. Nelson Annandale and H. C. Robinson, under the auspices of the universities of Edinburgh and of Liverpool, undertook a journey in Perak and the Siamese Malay States, having anthropological and zoological studies for its object. The results are set forth under the title 'Fasciculi Malayenses' (Longmans). A supplementary part of this is issued to show the itinerary of the travellers, and is provided with an excellent map. Two months were spent in the Batang Padang district of Southern Perak, while both travellers also made journeys in the following states: Senggora, Patani, Jalor, Nawngchik, Jhering, and Kedah. Mr. Annandale undertook exploration by himself in Central Perak, Upper Perak, Patalung, Trang, and Rhaman; and Mr. Robinson in Selangor. This supplement is in the nature of a diary and description of the places visited, and also summarizes the principal points of the work of the travellers. It is illustrated with a few excellent photographs. One point of strictly geographical importance is to be noted. The travellers observed a very distinct break in the main mountain range of the peninsula in Central Kedah—that is to say, between 6° and 7° N. In crossing here no great elevation was reached, nor were high mountains seen. It is, therefore, apparent that the mountain fauna of Perak has no continuous distribution to-day with that of Northern India, and the travellers state that their whole collection has served to confirm the belief "that the Malay peninsula is connected with India, as regards zoo-geography, in a degree not much more intimate than that which links it to Borneo."

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* See, *e.g.*, the report on the journey of Oshanin and Grumenitzki in *Proc. R.G.S.*, N.S., vol. x., 1888, pp. 638–646, with map.

Recent Elevation in the Moluccas.—The section of Prof. K. Martin's recently completed account of his geological observations in the Moluccas which has most general interest is that devoted to the raised coral reefs, and the evidence they yield of recent elevation of the land. The conclusion come to is the same as was reached by Mr. Günther from his work in the Bay of Naples—that the facts are inexplicable on the hypothesis that the land has stood still, and the level of the sea has altered. Though there was no opportunity for close accuracy of measurement, the scale of the phenomena is great enough to render this unnecessary; for instance, according to Prof. Martin, the hills of Haruku and Saparua are only 1000 feet in height, and are free from coral reefs near their tops, while in the neighbouring island of Ambon the coral reefs rise to a height of 1600 feet, the difference being over 600 feet in height, and the horizontal distance 10 to 15 miles. The greatest elevation above sea at which old coral reefs were found by Prof. Martin falls considerably short of the 5235 feet (1586 metres) at which one was found by Dr. Verbeek in eastern Timor.

The Naledi of Siberia.—The phenomenon called a *naled* by the Russians, and a *tarin* by the Yakuts, is a flooding of a river-valley above the ice. It has been alluded to by many writers on the country, but, as the guides know well where *naledi* are formed, and naturally avoid places where the traveller may unexpectedly be plunged into an icy-cold bath and lose his sledge and baggage, few, if any, have had an opportunity of thoroughly investigating their process of development. M. S. A. Podyakonof, during three years spent in the Yakutsk province, has thoroughly examined the *naledi* among which his work lay, and has given a detailed account of them in the *Izvestiya* of the Russ. Geogr. Soc., No. 4, 1903. A favourable site for a *naled* is a section of the course of a small mountain-stream consisting of a hollow in the base rock filled up with alluvium. On the top lies a thin layer of moss or vegetable soil, and below it a layer of mud or clay, and below this again loose or only slightly cemented pebbles with a mixture of gravel and sometimes boulders. When the frost has covered the stream with a layer of ice which checks the flow of the water, the latter begins to soak into this permeable detritus, at first falling to a lower level, but soon rising again as the thickening of the ice still further contracts the channel, and at length makes its way to the surface at those places where there is no covering of ice owing to the dryness of the surface or to the protection of a mantle of snow. The water thus brought to the surface may flow for some time, soaking the snow, until at length it becomes frozen, and the *naled* then appears as a sheet of ice, above which rise hillocks and snow-drifts. As the winter passes on, the surface is raised by the outflow of more water and the fall of snow, so that ultimately all inequalities are obliterated. In the spring when the thaw sets in the water cuts small runnels in the surface of the ice, gradually making its way down to the alluvium beneath, until the *naled* is fissured in all directions. Some ice often remains, however, till the height of summer, and reindeer resort to it for coolness and to escape the flies. On large rivers *naledi* are less common, but M. Podyakonof has observed them on the river Lena. The ice on the middle of the river is thrust upwards by the pressure of the water, and, pressing in its turn on the water, forces it out over the river-banks. This river flows northwards, and is frozen in the north while the autumn rains in the south are maintaining the flow of water in its bed. On rivers flowing southwards, as the Olekma, the water is checked in the north, and the ice below, from the absence of water sufficient to support it, sinks in the middle. M. Podyakonof describes several peculiarities of the *naledi*, among them blocks of ice raised above the general level and yet continuous with the surrounding ice. He attributes their formation to unequal freezing and expansion in hollows of the surface.

AMERICA.

Currents of the Newfoundland Coasts.—The Canadian Tidal and Current Survey continued its operations in 1903 on the southern and south-eastern coasts of Newfoundland, under the direction of Mr. W. Bell Dawson, and the results, which are of much interest from the light which they throw on the behaviour of currents in general in the neighbourhood of land masses, have been published this year at Ottawa by the Department of Marine and Fisheries. The primary object of the investigation was to ascertain what currents were to be met with by steamships following the usual route from Europe, and especially to elucidate the question of indraught into the large bays on the south coast, of which the largest, Placentia bay, is 75 miles deep and 45 miles wide. The results in regard to the polar current east of Cape Race are, however, of the most general interest. The system employed was to anchor the steamer (the *Gulnare*, 262 tons, of the Department of Marine and Fisheries) at carefully selected stations, and to make use of it as a fixed point from which the direction and speed of the current could be measured. This method possesses special advantages in a region so liable to fog as the one in question, where, if courses are run, long sights to fix the ends of these can rarely be had. The currents observed were almost invariably less than one knot, and as a rule they veered widely and were irregular in direction. A tidal element was found to be almost always present in some form, but with this is combined a tendency to make on the whole in some one direction. The effects of storms during summer seldom exercises a disturbing influence below 5 to 10 fathoms. On the south coast, when within 4 or 5 miles of the shore, the current is governed chiefly by the tide, and sets in the two opposite directions alternately. But the greater the distance out, the greater is the tendency to veer completely round the compass. Taking a long average, the set is most frequently northwestward along the south shore, from Cape Race toward Placentia bay, while on the eastern side of that bay the water on the whole makes inwards, and at certain times of the tide a corresponding indraught is felt on the east side of St. Mary's bay. These indraughts do not exceed one knot at an offing of 5 miles. The polar current sets very constantly to the south-west for a width of 30 to 40 miles off the eastern coast, but in times of disturbance (usually for part of a day preceding a gale), it may set south-eastward, or even be reversed, on the surface. Temperature observations showed (1) that the temperature of the water at 30 fathoms is practically at the freezing-point in all parts of this region, from the mouth of the Placentia bay to St. John's: it varied only from 30½° to 34° Fahr., and there was no seasonal change between May and September; (2) that the water of the polar current warms up at the surface quite as much as the surface water elsewhere in this region, though whether this may be due to warmer water flowing over it from elsewhere could not be ascertained. Sudden changes in the temperature of the surface water resulted from wind disturbance. An indication of the general set of the current is supplied by the icebergs, which always move to the south-westward, even when the surface water, and with it the flat or pan ice, may set in quite a different direction under the influence of the wind.

The Bahamas.—The Blue-book for 1902 on the Bahamas furnishes, beyond the scope of the average official report, a comprehensive summary of their geography (including geology, climate, and meteorology), political history, and economic and cultural condition. The text is also illustrated by a map and thirty-two photographs of typical scenes and objects; while a bibliography is included. Altogether, the Report supplies an excellent basis for a general appreciation, reciprocally scientific and practical, of the islands. The islanders themselves, who have no cause to complain of fortune, might be well advised to study their Governor's judicious review of the situation and his suggestions towards its improvement. As adverse factors in this group of islands are enumerated—(1) scantiness of soil and defect of natural water-supply; (2) lack of adequate population, and their lack in turn of sufficient enterprise; (3) want of harbours to accommodate other than small craft; (4) want of regular steam-communication with the other islands. Among favourable factors, on the other hand, is the climate; delightful in winter, and even in summer, though hot, yet seldom oppressive. Nassau, though still without the usual sensational accompaniments of holiday resorts, is likely, by the mere attraction of its climate, scenery, and bathing facilities, to continue a favourite winter resort for dwellers on the adjacent continent, its climate being undoubtedly superior to that of any of the Florida resorts. Its one drawback is that it can be reached only by sea, and the voyage, though only of sixteen hours, has, owing to the necessities of draught at both ports, to be made in a vessel of restricted size. The attractions of Nassau are possessed more or less by numberless other spots, especially on the western side of the Exuma Cays. The Exuma Cays are, moreover, admirably suited to form sanatoria for consumptive patients. They are highly picturesque, and with proper arrangements and accommodation might be made very attractive to residents. On them malaria is a practical impossibility. Rainfall, moreover, is there much more limited than in the larger islands. Though not rising more than 100 feet above sea-level, none of the islands are quite flat. In the Bahamas generally, agriculture, scientifically pursued, repays effort. Sisal plantations especially, worked on proper lines, yield good results. The culture bids fair to be permanent and profitable, no other economic plant being so well suited as the agave to the peculiar conditions of the Bahamas. The sponge industry will continue to be a valuable means of support to the merchants and collectors. Charges of damage done to the beds by collection of immature specimens continue to be made, but so far no steps have been taken to correct the abuse. By a curious slip, Nassau, the capital, is, on p. 10, said to have received its name in compliment to the House of "Hanover" instead of Orange.

The British Guiana-Brazilian Boundary.—By the award of the King of Italy, given on June 15 last, the last of the questions at issue in regard to the boundaries of British Guiana—that with Brazil—has been finally set at rest. The decision is avowedly a compromise, for while holding that the guiding principle in the decision must be that of the acquirement of rights by definite acts of occupation or extension of influence, the arbitrator finds that in the case of the disputed territory it is impossible to define clearly the limits to which the influence of the two parties to the dispute has extended. He has therefore given preference to such natural dividing lines which seem best to lend themselves to an equitable division of the territory. The line thus fixed starts from Mount Yakontipu, at the source of the Kotinga; runs east along the water-parting to the source of the Ireng or Mahu; follows this river down to its junction with the Takutu, which it ascends to its source, there joining the undisputed part of the frontier as fixed in November, 1901. It will be remembered that the British claim carried the frontier in its northern section along the Kotinga instead of the Ireng, and that the intervening strip is therefore gained by Brazil. On the other hand, the British claim is substantiated in the more southern section, where the Brazilian claim included the strip of territory between the Takutu and the Rupununi.

The Dutch on the Amazon.—In the *English Historical Review* for October last, Mr. George Edmundson elucidates a number of points in the history of the Dutch on the Amazon in the seventeenth century. Acquainted as early as 1580 with the Brazilian coast, the Dutch had, by the end of the sixteenth century, erected two fortified trading stations, Orange and Nassau, on the Xingu. In 1605, as we learn from Purchas's 'Pilgrims,' one of the English colonists settled at Wiapoco reported the presence of three Dutch vessels on the Amazon. One of them, the *Hope*, trading under an English captain for Amsterdam merchants, he found to be on a six months' visit to Wiapoco, where it had been the year before. Writing April 4, 1615, to the Council of the Indies, the Duke of Lerma reported, evidently on the testimony of an agent in Spanish pay at the Hague, the return from the Wiapoco of a captain of the Flushing fleet and his son. There they had erected two houses, cultivated tobacco, and made a cruise of 100 leagues up the river. The report further notes a commercial company of Flushing, headed by its burgomaster, asking aid of the Estates of Holland to explore the whole length and breadth of the Amazon. In 1614 the Estates of Holland had offered a limited monopoly to pioneers in foreign settlements. These early settlements on the Amazon are described, now as English and now as Dutch, because the settlers from the cautionary towns (Flushing, etc.) included a considerable intermixture of English. Before the end of 1616 the Dutch had one settlement on the Essequibo and another on the Amazon. A well-authenticated account of both is contained in the manuscripts of Major John Scott. The eye-witness from whom Scott draws his information about the Amazon settlement figures in the manuscript as "Vuyler"—a clerical misreading under which Mr. Edmundson recognizes the famous Admiral de Ruyter. Dutch enterprise on the Amazon did not long enjoy the favour of fortune. In the early part of 1623 Maciel Parente, Captain-General of Grão Pará, a man of uncommon energy, ousted the Dutch from Corupá station (north bank of main stream, near mouth of Corupá) and from the Xingú, and built a fort at Corupá opposite the former Dutch post. In November of the same year Peter Jansz of Flushing drove the Portuguese garrison out of Corupá. Next, Captain Oudaen was sent by the West Indian Company to establish himself firmly at this critical point of vantage. Dutch ambition on the Amazon received its final blow when a powerful fleet under Pedro Teixeira swept the Dutch out of Corupá. The entries of trading on the Amazon disappear in 1628 from the Zeeland Chamber's minutes of proceedings, as also from De Laet's *Jaerlijck Verhaal*. What desultory Dutch trading still lingered after 1629 was confined to the immediate neighbourhood of the Cabo do Norte.

Old Cartography of the North Coast of Brazil.—In connection with the tercentenary of the first settlement of the state of Ceara, Dr. O. A. Derby has made a study of the early maps of this coast and the voyages on the results of which they were based. He has embodied the results in the memorial volume published by the Ceara Historical Institute, and a translation of his paper appeared in *Science* for April 29 last. The earliest map to show this coast is of course that of Juan de la Cosa, which was based not only on the voyage of Hojeda (1499), in which that pilot took part, but apparently on the voyages of Pinzon and Lepe shortly afterwards, as the nomenclature is fairly full for the coast between the Orinoco and Cape San Roque. Dr. Derby thinks that the Cape Santa Maria of Pinzon was some point to the west of the latter, whereas it may be remembered that some writers have identified it with Cape São Augustinho, the most easterly point of South America. He thinks, however, that it was rather Lepe's than Pinzon's voyage that inspired the nomenclature of this part of the map. The Cantino map of 1502 shows here a very scanty nomenclature, but new data appear on the maps of Freducci (about 1514 ?), Maiollo (1519), and the anonymous map of 1523, known as the Turin map. The last-named would seem to be based on a Portuguese voyage, of which the record is lost, and the data given by it did not become part of the general knowledge of the time. With regard to the name Maranon (which appears on the Freducci map to the east of the Amazon mouth), Dr. Derby thinks that it was given, either by Lepe or by some navigator of whom we have no knowledge, to a topographical feature of the coast of Maranhão, and was afterwards transferred to the Amazon by a mistaken identification. He points out that the name (which often has the article *o* prefixed) may be a corruption of o Marachão (a barrier of sand or gravel)—a term which would apply well to this coast. In favour of the idea that the name was due to another expedition than Lepe's, he quotes the letter of Estevão Froes, witten in 1514, in which reference is made to a previous voyage by João Coelho (identified by Dr. Derby with the João de Lisboa, known to have been a pilot about this time, whose name is associated with this coast in a series of later maps). As Froes made his voyage in company with Francisco and Pero Corso, and speaks of having found a certain Pero Gallego living with the Indians of the coast in question, we have a probable explanation of the Cape Corso and Rio Pero found on the Maiollo map. The maps of 1527 and 1529 (the latter, and probably the former also, by Diego Ribero) did not add to the stock of knowledge of this part of Brazil, but from 1534 onwards we find a number of maps, including those of Gaspar Viegas, Alonso de Santa Cruz, Sebastian Cabot, Diego Gutierrez, Diogo and André Homem, and others, on which a new and more accurate topography of this part of the coast appears. It is marked especially by the excellence of its delineation of the hydrographical basin of Maranhão, and is attributed by Dr. Derby to the voyage, in 1531, of Diogo Leite, who may possibly have found the Pero Gallego of Froes still living on the coast, and obtained the information from him. Another feature in these maps is their mistaken notions regarding the Amazon, which was for a time suppressed entirely, and afterwards inserted erroneously. From about 1560 onwards the maps were marked by an imaginary representation of the interior, the lakes and rivers of which, shown by Gutierrez in 1562, found their way into the atlases of Ortelius, Mercator, and their successors.

AUSTRALASIA AND PACIFIC ISLANDS.

Midway Islands, North Pacific.—The Rev. A. B. Weymouth sends us from Lahaina, in Hawaii, some notes on Midway islands, supplied by Mr. S. Macmichael, one of the fifteen persons regularly stationed on the islands, which are situated some distance to the west-north-west of the main Hawaiian group in about 28° 13′ N., 177° 21′ 30″ W. They are the site of a cable station, and the inhabitants consist of the superintendent and his wife, the assistant-superintendent, four cable operators, a doctor, batteryman, four Chinese servants, and two labourers. There are two islands in the group—Eastern island, about one mile long by half broad, covered with coarse grass and small shrubs; and Sand island, 1¾ mile long by one mile broad, consisting almost entirely of pure sand except at the two ends. The highest point is Observation hill on Sand island, 30 feet above sea-level. Good water is found on this island at a depth of 5 or 6 feet, but, owing to the amount of drifting sand, attempts at cultivation have met with slight success, though rather more on Eastern island. There are no native animals on either island, but innumerable sea-birds of some twenty species, besides a small number of curlew and plover. There are some small "wingless" birds on Eastern island, brought some years ago from Laysan, another isolated island in this part of the Pacific. Steamers do not call regularly, and during the winter storms it is uncertain whether boats can reach the shore. The climate seems colder than at Honolulu, and winter temperatures as low as 57° have been registered.

POLAR REGIONS.

Bénard's proposed North Polar Expedition.—In the middle of June a conference was held in Paris, under the presidency of the Prince of Monaco, to discuss a new polar expedition, planned by Mr. Charles Bénard, President of the Oceanographical Society of Bordeaux. Mr. Bénard, whose plans are put forward at length in a recent number of the *Bulletin* of the Monaco Oceanographic Museum, urges that the number of yearly journeys to definite regions should be increased, and cites the good work accomplished by the Danes in Greenland during the last thirty years as an example of what can be done in this way. At the same time he desires that a strenuous effort should be made to explore the unknown polar sea, by repeating Nansen's voyage with two ships, starting at about 150° E., *i.e.* further east than Nansen did. The two vessels would keep about 100 miles apart, and be in constant communication with each other by wireless telegraphy. The expedition would probably last three years, but both ships would be provisioned for five.

The Ziegler Arctic Expedition.—As the *America*, the ship of the Ziegler Expedition, under the command of A. Fiala, which went to Franz Josef Land last autumn, has not returned, it is surmised that, owing to the unfavourable ice-conditions of last year it may not have reached its goal, but have been caught in the ice. Mr. Ziegler has bought a Norwegian steam-whaler, and sent it to discover the whereabouts of the *America* and to carry provisions to the expedition, which was to have wintered in Teplitz bay. Mr. Champ is leader, and the ship started from Tromsö on April 1.

The Danish Expedition to North Greenland.—It is announced in *Petermanns Mitteilungen* (No. vi., 1904) that Mylius Erichsen and his companions, Count Moltke and Mr. Rasmussen of the Danish Expedition to North Greenland, about whose fate some concern had been felt, spent several months in Saunders island, in the north of Baffin's bay, with the natives under straitened conditions. On January 20 they started on snow-shoes for the south, crossed Melville bay, and reached Upernivik in safety. They will remain in Greenland all summer, and return with the last ship to Europe. For the first time in this way the Cape York Eskimo have been brought into touch with their relations in North Greenland.

Return of the "Scotia."—The *Scotia*, with Mr. Bruce and the members of the Scottish Antarctic Expedition on board, arrived safely in the Clyde on July 21, receiving a warm welcome. A telegram of congratulation from the King was read by Sir John Murray, and similar telegrams were received from Sir Clements Markham and others interested in the expedition. The gold medal of the Scottish Geographical Society was presented to Mr. Bruce by Sir John Murray, a gold watch-seal being also presented to Captain Robertson.

Ellesmere Land.—In a communication dated June 8 last, the Secretary to the Geographic Board of Canada informs us that the board has adopted the name "Ellesmere Land" for the large insular area in the Arctic region situated, approximately, between 76° and 84° N., and between 62° and 90° W. The name has hitherto been generally applied to the more southern portion only, but now that it has been definitely ascertained that the land forms one undivided mass, it is fitting that one name should designate the whole, though possibly the form "Ellesmere Island" might have been preferable.

The Fossil Flora of the Antarctic.—Dr. Nathorst has lately communicated to the Paris Academy of Sciences (*Comptes Rendus*, June 6, 1904) a note on the recent discoveries, by members of the Swedish Antarctic Expedition, of fossil plants dating from Jurassic and Tertiary times. The most interesting find, it will be remembered, was that made by Dr. J. G. Andersson at Hope bay in Louis Philippe Land (63° 15′ S., 57° W.), where a Jurassic flora, very rich in species and with the leaves well preserved, was found in a black schistose formation, forming part of an old range of mountains and attaining a thickness of some 2000 feet. Besides Equisetineæ, ferns, etc., the remains include species of conifers, and the general character of the flora resembles that of the Jurassic flora of Europe and of the Upper Gondwana of India. No climatic differences from either of these can be distinguished, and from this point of view the collection might equally well have been made on the coast of Yorkshire. The Tertiary remains were found on Seymour island in about 64° 15′ S., where Captain Larsen had already, in 1893, obtained specimens of fossil wood, recognized by English geologists as belonging to a conifer, as well as other remains, among which Dr. Andersson had recognized an Angiosperm. Among those recently discovered, which occurred in a marine volcanic tuff, Dr. Andersson has recognized specimens of a conifer resembling at first sight a *Sequoia*, though probably belonging to another genus; an *Araucaria*, apparently allied to *A. Braziliensis;* and certain Dicotyledonous plants with small leaves, corresponding with those of certain Tertiary floras of Southern Europe. Especially interesting is the occurrence of leaves of a *Fagus*, which genus must therefore, it seems, have existed either here or in South America since the beginning of the Tertiary epoch. Dr. Andersson points out the need of caution in drawing conclusions, from these remains, regarding the climate of the Antarctic Regions in those times, the formation in which they occur being marine in origin, while Prof. Agassiz has obtained leaves, wood, and fruits from the ocean bottom over 600 miles from the nearest land.

GENERAL.

The Eighth International Geographical Congress.—An announcement dated June, 1904, gives further details of the arrangements for the Washington meeting of the International Geographic Congress. Although the general programme has already been summarized in the *Journal*, it may be useful to those purposing to take part in the Congress to recapitulate somewhat, in order to present a more or less complete outline of the proposed proceedings. After assembling informally in Washington on the evening of September 7, the Congress will formally "convene" on Thursday, September 8, at 10 o'clock. It will reconvene in Philadelphia on Monday, September 12, at 9 o'clock; and again in New York, Tuesday, September 13, at 10 o'clock. After a field meeting at Niagara Falls, on Friday, September 16, it will reassemble in Chicago on Saturday, September 17, at 10 o'clock; and will finally meet in St. Louis, in conjunction with the International Congress of Science and Arts, on Monday, September 19, at 10 o'clock. The meetings will be classified as—(1) General Sessions, usually held in the forenoon;

(2) Sectional Meetings, usually afternoon; (3) Field Meetings; (4) Evening Lectures; and (5) Social Gatherings. Until September 7, the office of the Congress will be in the Hubbard Memorial Hall (National Geographic Society), corner of 16th and M Streets, N.W., Washington. On that day the records will be transferred to the Ebbitt House, 14th and F Streets, N.W., and this hotel will remain the headquarters during the stay in Washington. On September 12 an office for registration will be opened at the headquarters of the Geographical Society of Philadelphia, 1520, Chestnut Street, and on the morning of the 13th in New York at the American Geographical Society building, 15 West 81st Street, which will be the headquarters during the stay in that city. On September 17 an office will be opened in Cobb Hall, University of Chicago, and on the morning of the 19th in the Hall of Congresses, St. Louis Exposition. On Saturday, September 24, the headquarters will be once more transferred to the Hubbard Memorial Hall, Washington, where all correspondence should be directed down to the final closing of the Congress. Persons taking part in the meeting are requested to register on the earliest possible date at the local headquarters of the city in which they first attend the Congress, those who join at Washington being, especially, asked to be prompt in recording their names and local addresses. The following programme of the meeting has been provisionally arranged: *September* 7—Evening, informal reception by the National Geographic Society. *September* 8—10 a.m., formal opening in the George Washington (Columbian) University Hall, 15th and H Streets; 2.30 p.m., visits to Scientific Bureaus; 8 p.m., lecture. *September* 9—10 a.m., General session, devoted especially to Government surveys; 2.30 p.m., Sectional meetings; 5 p.m., reception by Mrs. G. G. Hubbard; 8 p.m., lecture by Dr. Von Drygalski. *September* 10—Sectional meetings; reception by President and Mrs. Peary (8 p.m.). *September* 11—Water excursion on lower Potomac; 7 p.m., start for Philadelphia. *September* 12—Visits to Philadelphia Institutions; field meeting in Fairmount Park; subscription dinner to foreign guests; start for New York. *September* 13—General session, devoted to Oceanography, introduced by an address from Sir John Murray; sectional meetings; public lecture (8 p.m.); reception by American Geographical Society. *September* 14—Sectiona meetings, in the afternoon devoted to Commercial Geography. *September* 15—Excursion up the Hudson, with field meeting on Mount Beacon. *September* 16—Field meeting at Niagara Falls, with address by Mr. G. K. Gilbert, etc. *September* 17—Arrival at Chicago (8 a.m.); general session at Cobb Hall; visits to institutions; reception by Geographical Society (8 p.m.). *September* 18—Excursion to view lake-front (provisional); start for St. Louis (10 p.m.). *September* 19—Arrival at St. Louis (8 a.m.); meeting with World's Congress of Science and Arts (10 a.m.); inspection of exhibits. *September* 20 and 21—Meetings with World's Congress; lecture by Commander Peary (8 p.m. on 20th). *September* 22—Formal session closing the Congress. Special transportation rates have been arranged, that from Washington to New York being $5, and from New York to Chicago and St. Louis and back, including sleeping-car and meals during outward journey, $45. The cost of the Far West excursion, which will leave St. Louis on September 24, and occupy twelve to fourteen days, will be approximately $150. As already announced, membership is acquired by members of geographical and cognate societies on payment of $5 (£1); by other persons, on a similar payment and election by the Presidency. Ladies and minors accompanying members may be registered as associates on payment of half the above sum, and they enjoy all privileges except the right of voting and receiving publications. The list of papers offered down to June 1 numbers some two hundred, many of the foremost geographers both of America and Europe being represented.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1903–1904.

Fifteenth Ordinary Meeting, June 27, 1904.—Sir CLEMENTS MARKHAM, K.C.B., F.R.S., President, in the Chair.

ELECTIONS.—*L. S. Coke (Irish Guards); Arthur C. Cooke; Captain E. E. Edlmann, D.S.O., R.A.; Frederick Anthony Floyer, B.A., M.B., Camb.; Wm. McLaren, M.A., B.Sc.; Percy Falcke Marks; Thomas Lillis Molony; Captain E. Mackenzie Murray (3rd Black Watch); Ambrose Petrocokino; Augustus Racester.*

HONORARY CORRESPONDING MEMBERS.

Senhor Augusto Ribeiro, Head of the Political Department, Portuguese Colonial Office; Dr. Don Eulogio Delgado, President of the Lima Geographical Society.

The Paper read was:—

"The Anglo-French Boundary Commission in Nigeria." By Colonel G. S. McD. Elliot, R.E.

A series of photographs of Lhasa and its Neighbourhood, taken by recent Russian visitors to Tibet, were exhibited on the lantern screen by the President.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Com. = Commerce.
C. Rd. = Comptes Rendus.
Erdk. = Erdkunde.
G. = Geography, Geographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
k. u. k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. = Memoirs, Mémoires.
Met. = Meteorological.
P. = Proceedings.
R. = Royal.
Rev. = Review, Revue.
S. = Society, Société, Selskab.
Sitzb. = Sitzungsbericht.
T. = Transactions.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Alps. *B.S.G. Italiana* 5 (1904): 13-34, 92-112, 193-223. **Marinelli.**
Studi Orografici nelle Alpi Orientali. Por Olinto Marinelli. *Illustrations.*

Alps—Monte Rosa. *Atti R.A. Lincei, Rendiconti* 13 (1) (1904): 400-408. **Oddone.**
Per lo studio della temperatura dell' aria alla sommità del Monte Rosa. Nota di E. Oddone.

Austria Hungary—Budapest. **Körösy and Thirring.**
Die Hauptstadt Budapest im Jahre 1901. Von Dr. Josef v. Körösy und Dr. Gustav

Thirring. I. Band, I. Hälfte. (Publ. des Statistischen Bureaus, Budapest, xxiii. I. i.) Berlin, 1903. Size 11 × 7½, pp. 62. *Map.*

Ems—Ports. **Beekman.**
Tijds. Konink. Neder. Aardrijk. Genoots. 2de Ser. 21 (1904): 311–338.

De Havens van Emden en Delfzijl. Door A. A. Beekman. *Maps.*

Europe—Lakes. **Halbfass.**
Z. Ges. Erdk. Berlin (1903): 592–623, 706–729, 784–813; (1904): 204–223.

Die Morphometrie der Europäischen Seen. Von Prof. Dr. W. Halbfass. *Also separate copy presented by the Author.* [See note in Monthly Record, *ante.*]

France—Ancient Districts. *B.G. Histor. et Descript.* (1903): 236–238. **Saint-Jours.**

Limite des différents Pays (Pagi) de la Gironde à la Bidassoa. Par M. Saint-Jours.

France—Gascony—Shingle Beds. *B.G. Histor. et Descript.* (1903): 189–217. **Fabre.**

Les Galets des Plages Gasconnes. La Pénéplaine Landaise. Par M. L.-A. Fabre.

France—Landes. *B.G. Histor. et Descript.* (1903): 274–289. **Duffart.**

La Carte Manuscrite de Claude Masse (Fin du XVIII^e Siècle). Sa Valeur Scientifique. Principales Modifications du Sol Landais qu'elle révèle. Par M. Charles Duffart.

France—Lys. *B.S.G. Lille* 41 (1904): 266–272. **Malotet.**

La plaine de la Lys en France. Par A. Malotet.

France—Médoc. *B.G. Histor. et Descript.* (1903): 323–369. **Pawlowski.**

Les Villes Disparues et la Côte du pays de Médoc, d'après la Géologie, la Cartographie et l'Histoire. Par M. Auguste Pawlowski.

France—Neste. *B.G. Histor. et Descript.* (1903): 308–317. **Marsan.**

La Neste autrefois et aujourd'hui. Par l'Abbé F. Marsan.

The Neste is a left-bank tributary of the Garonne.

France—Roman Roads. *B.R.S.G. Madrid* 46 (1904): 59–67. **Blázquez.**

Estudio acerca de algunas vias romanas en Francia. Por A. Blazquez. *With Map.*

Germany—Geodesy. ———

Veröffentlichung des Königl. Preussischen Geodätischen Institutes. N. F. No. 15. Astronomisch-Geodätische Arbeiten I. Ordnung. Bestimmung der Längendifferenz Potsdam—Greenwich im Jahre 1903. Berlin: P. Stankiewicz, 1904. Size 11½ × 9, pp. 78. *Plate.*

Germany—Northern Plain. **Baren.**
Tijds. K. Ned. Aardr. Genoots. Amsterdam 21 (1904): 453–477.

De morphologische bouw der Noord-Duitsche laagvlakte. Door J. van Baren.

Germany—Silesia—Zobtenberg. *Globus* 85 (1904): 85–89. **Lustig.**

Die Trichter-Gruben (Mardellen) vom Zobtenberge in Schlesien. Von Dr. Georg Lustig. *Illustrations.*

Greece—Thessaly. **Merlin.**

Trade and Agriculture of the Province of Thessaly for the year 1903. Foreign Office, Annual No. 3148, 1904. Size 9½ × 6½, pp. 26. *Price* 2*d.*

Italy—Naples and Sicily. **Haas.**

Neapel, seine Umgebung und Sizilien. Von Prof. Dr. H. Haas. (Land und Leute. Monographien zur Erdkunde . . . herausgegeben von A. Scobel. xvii.) Bielefeld und Leipzig: Velhagen & Klasing, 1904. Size 10½ × 7, pp. 194. *Maps and Illustrations. Price* 4 *m.*

Portugal—Cartography. *B.S.G. Lisboa* 21 (1903): 451–460. **D'Eça.**

A Cartographia Maritima Portugueza e os seus Antecedentes. Por Vicente Almeida d'Eça.

Rhine. *Tijds. K. Nederl. Aardr. Genoots.* 21 (1904): 364–368. **Lorié.**

De vorming van het Rijndal. Door Dr. J. Lorié.

Rumania. *C. Rd.* 138 (1904): 1058–1060. **Martonne.**

Sur l'évolution du relief du plateau de Mehedinti (Roumanie). Note de E. de Martonne.

Russia—Gravity. *Iz. Imp. Russian G.S.* 39 (1903): 295–304. **Drubiago.**

Determinations of Gravity in the Urals carried out at the Kazan Astronomical Observatory in 1899, 1900, and 1902. By D. T. Drubiago. [In Russian.]

Russia—Murman Coast. **Breitfuss.**

L. L. Breitfuss. Expedition für wissenschaftlich-praktische Untersuchungen an der Murman-Küste. Bericht über die Thätigkeit pro 1902. [In Russian.] St. Petersburg, 1903. Size 12 × 8½, pp. x., 328, and 218. *Maps and Illustrations. Presented by M. L. L. Breitfuss.*

Russia—Volga and Caucasus. **Rossmässler**

Deutsch. Rundschau G. 26 (1904): 199-205, 255-264, 315-318.

Völkerkundliche Skizzen aus dem Gebiete der Wolga und des Kaukasus. Von F. Rossmässler. *With Illustrations.*

Servia. **Kanitz.**

Felix Kanitz. Das Königreich Serbien und das Serbenvolk von der Römerzeit bis zur Gegenwart. Erster Band. Land und Bevölkerung. Leipzig: B. Meyer, 1904. Size 11 × 7½, pp. xiv. and 656. *Illustrations. Price* 20*s*.

This work is to be completed in three volumes, the manuscript of the whole having been made ready for the press before the author's death in January last. Of the present volume, the opening chapters give a sketch of Servian history, while the remainder supplies a detailed description of the country in the form of itineraries.

South-Eastern Europe. **Richardson.**

Vacation Days in Greece. By R. B. Richardson. London: Smith, Elder & Co., 1903. Size 8½ × 5½, pp. xiv. and 240. *Maps and Illustrations. Price* 7*s*. 6*d*. *Presented by the Publishers.*

Accounts of journeys in Greece, Sicily, and Dalmatia by a former director of the American School of Archæology at Athens. In Greece, the routes led frequently off the beaten paths, and the narrative presents a vivid picture of parts of the country little visited by tourists.

Sweden. *Ymer* 24 (1904): 17-42. **Conwentz.**

Om skydd åt det naturliga landskapet jämte dess växt- och djurvärld, särskildt i Sverige. Af H. Conwentz. *With Maps and Illustrations.*

On the protection of natural landscapes, with the associated plant and animal life.

ASIA.

Asia—Yezidis. *S.G. l'Est* 24 (1903): 281-306, 429-445. **Perdrizet.**

Documents du XVIIe Siècle relatifs aux Ye'zidis. Publiés par Paul Perdrizet.

Baluchistan. *J. Asiatic S. Bengal* 72 Pt. iii. (1903): 53-60, 66-71, 72-80. **Rai.**

Note about certain sections of the Kakars living in the Zhob District of Baluchistan. Collected by Rai Sahib Diwan Jamiat Rai.

Notes on the Hindus in the Nushkī Tahsil of the Chagāī Agency in Baluchistan. By the same.

Notes about the Wanĕcīs (Spin Tarīn Afghāns) of the Shahrig Thasil, Thal-Chotiali, Baluchistan. By the same.

Caspian Sea. **Spinder and Lebedintseff.**

The Work of the Karabugaz Expedition. Report to the Russian Ministry of Agriculture and Domains. 1. Hydrology, by T. B. Spindler. 2. Chemistry, by A. A. Lebedintseff. Size 10 × 7, pp. 177. St. Petersburg, 1902. [In Russian.]

Noticed in vol. xxiii. p. 500.

Central Asia. *Zap. Imp. Russian G.S., General G.* 38 (1903): No. 1. ———

From India to Ferghana. Description of a Journey made in 1898. By V. F. Novitsky. St. Petersburg, 1903. Size 10 × 7, pp. 297. *Map and Plates.* [In Russian.]

Noticed in the *Journal* for April, 1904 (p. 501).

Ceylon—Pearl Fishery. **Thurn.**

A Sketch of the Ceylon Pearl Fishery of 1903. By Everard im Thurn. Size 9½ × 6, pp. 10. *Presented by the Author.*

China. *Verh. Deuts. Kolon. Ges., Abt. Berlin-Charlottenburg* 8 (1904): 1-29. **Franke.**

Geistige Strömungen im heutigen China. Von Dr. O. Franke. *Presented by Dietrich Reimer, Berlin.*

On the tendency of ideas in present-day China.

China. **Madrolle.**

Madrolle. Chine du Nord et de l'Ouest, Corée, le Transsibérien. Pp. xii., 144, 38, and 68. *Maps and Plans.* Ditto. Chine du Sud et de l'Est. Paris: Comité de l'Asie Française, 1904. Size 7 × 4½, pp. xii., 12, cviii., and 156. *Maps and Plans. Price, each vol.,* 12 *fr.*

The first attempt at a systematic guide to travellers in China, which should prove of much use. The books include sketches of Chinese history and literature, and an elementary grammar of the language, in addition to the usual practical directions with regard to routes, etc.

Eastern Asia—Sailing Directions. ———

Sailing Directions for Japan, Korea, and adjacent seas, from Yalu River, the boundary between Korea and China, to the Komandorski Islands; also the Ogasawara (Bonin) Islands, etc., southward of Japan, and the Kuril Islands. Formerly published as China Sea Directory, vol. iv. First Edition. London: J. D. Potter, 1904. Size 9½ × 6, pp. xxvi. and 864. *Index Maps. Price* 5*s. Presented by the Admiralty.*

French Indo-China. *B. Comité l'Asie Française* 3 (1904): 176–182. **Madrolle.**

Le Royaume de Luang-Prabang et le Traité Franco-Siamois. Par C. Madrolle. *With Map.*

French Indo-China—Annam. **Gosselin.**

Capitaine Ch. Gosselin. L'Empire d'Annam, Préface de Pierre Baudin. Paris: Perrin et Cie, 1904. Size 8 × 5½, pp. xxvi. and 560. *Map. Price* 3*s.* 9*d.*

A useful summary of the history of Annam, both under its native rulers and under the French occupation.

French Indo-China—Tonkin. **Baldinotti.**

B. l'École Française d'Extrême-Orient 3 (1903): 71–78.

La Relation sur le Tonkin du P. Baldinotti.

India. **Connor.**

Trigonometrical Branch, Survey of India. Spirit-levelled Heights, Bengal and Assam. Seasons 1899–1902. Prepared by E. J. Connor. Dehra Dun: 1903. Size 10 × 6, pp. xii. and 74. *Map.*

India—Irrigation. **Wilson.**

Irrigation in India (Second Edition). By H. M. Wilson. (United States Geological Survey, Water-Supply and Irrigation Paper No. 87.) Washington, 1903. Size 9½ × 6, pp. 238. *Map, Plans, and Illustrations.*

A carefully revised edition of the original report issued in 1891.

India—Karakoram. *La G., B.S.G. Paris* 9 (1904): 249–256. **Bullock-Workman.**

Exploration des Glaciers du Kara-Korum. Par Fanny Bullock-Workman. *With Illustrations.*

India—Meteorology. *J. Asiatic S. Bengal* 72, Pt. ii. (1903): 239–251. **Little.**

Himalayan Summer Storms and their Influence on Monsoon Rainfall in Northern India. By C. Little.

India—Pāṭaliputra. **Waddell.**

Report on the Excavations at Pāṭaliputra (Patna), the Palibothra of the Greeks. By L. A. Waddell. Calcutta: 1903. Size 10 × 6½, pp. 84. *Plans and Plates. Presented by the Bengal Government.*

Includes a sketch of the history of the ancient Pataliputra, an account of the discovery of the site, and descriptions of the ancient buildings and sculptures of Asoka's time.

India—Punjab. *Records Geolog. Surv. India* 31 (1904): 9–34. **Simpson.**

Report on the Coal Deposits of Isa Khel, Mianwali, Punjab. By R. R. Simpson. *With Maps.*

Korea. *Tour du Monde* 10 (1904): 133–156. **Hagen.**

Un Voyage en Corée. Par Dr. A. Hagen. *Illustrations.*

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Tijds. K. Ned. Aardr. Genoots. Amsterdam 21 (1904): 203–226.

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Malay Archipelago—Moluccas. **Martin.**

Reisen in den Molukken, in Ambon, den Uliassern, Seran (Ceram) und Buru. Eine Schilderung von Land und Leuten. Von K. Martin. Leiden: E. J. Brill

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Malay Archipelago—Siboga Expedition. **Weber and Tydeman.**
Ann. Hydrographie 32 (1904): 97–107.

Die niederländische Tiefsee-Expedition auf der *Siboga.* Nach Prof. M. Weber und F.-Kapt. G. F. Tydeman. Bearbeitet von Dr. Gerhard Schott.

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Manchuria and Port Arthur. By Colonel C. E. de la Poer Beresford.

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Die Eroberung der Mandschurei durch die Transbaikal-Kosaken im Jahre 1900, von N. A. Orloff. Deutsch von Ullrich. Strassburg i. E.: Wolstein und Teilhaber, 1904. Size 8½ × 5½, pp. 206. *Map. Price* 3*s.* 8*d.*

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Die Mandschurei, nach dem vom Russischen grossen Generalstabe herausgegebenen "Material zur Geographie Asiens." Uebersetzt von R. Ullrich. Berlin: K. Siegismund, 1904. Size 9 × 6½, pp. 52. *Map. Price* 1*s.*

Manchuria—Port Arthur. *Nineteenth Century* 55 (1904): 618–629. **Longford.**

The History of Port Arthur. By J. H. Longford.

Persia—Ornithology. **Zarudnyi.**
Zap. Imp. Russian G.S., General G. 36 (1903): No. 2.

Birds in Eastern Persia. Ornithological results of a journey in Eastern Persia in 1898. By N. Zarudnyi. Size 10 × 6½, pp. 467. St. Petersburg, 1903. *Illustrations.* [In Russian.]

See review, *ante*, p. 83.

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The Present Situation in the Persian Gulf. By E. Cotes.

Philippine Islands. **Landor.**

The Gems of the East. Sixteen Thousand Miles of Research Travel among Wild and Tame Tribes of Enchanting Islands. By A. Henry Savage Landor. 2 vols. London: Macmillan & Co., 1904. Size 9 × 6, pp. (vol. i.) xii. and 328; (vol. ii.) xii. and 460. *Map and Illustrations. Price* 30*s. net. Presented by the Publishers.* [To be reviewed.]

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Orographie de la Sibérie précédée d'une introduction et d'un Aperçu de l'Orographie de l'Asie. Par Pierre Kropotkine. (Université Nouvelle, Institut Géographique de Bruxelles, Publication No. 9.) Bruxelles, 1904. Size 10 × 6½, pp. 120. *Maps and Section.*

Translation of the monograph published in 1876 in the *Mémoires* of the Russian Geographical Society, with an introduction and summary of the present state of our knowledge of the orography of Asia, on which the author's views were put before the readers of the *Journal* in February and March.

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See note in vol. xxiii. p. 785.

Russia—Siberia—"Naledi." *Is. Imp. Russian G.S.* 39 (1903): 305–337. **Podyakonof.**

On the "Naledi" of Eastern Siberia and the causes to which they are due. By S. A. Podyakonof. *Illustrations.*

See note, *ante*, p. 224.

AFRICA.

Abyssinia—Kaffa. **Villespy.**
Missions Cath. 36 (1904): 22–23, 28–33, 45–47, 57–59, 66–72.

La Mission de Kaffa. Par le P. Séraphin de Villespy. *With Map and Illustrations.*

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Lucien Hubert. Politique Africaine. Maroc, Afrique occidentale, Algérie, Tchad, l'Effort étranger. Préface de M. Eugène Étienne. Paris: Dujarric & Cie., 1904. Size 7½ × 5, pp. 302. *Price* 3.50 *fr.*

Deals chiefly with the French possessions, but contains a chapter on modern railway enterprise in Africa generally.

Bantu Race. *Deuts. Rundschau G.* **26** (1904): 145–150. **Bencke.**

Ein Beitrag zur Ethnographie Afrikas. Von Albert Bencke.

Discusses the origin of the Bantus.

British Central Africa. ——

British Central Africa Protectorate. Diary, 1904. With Official Handbook on the Protectorate compiled in the Secretariat, B.C.A.A. Zomba. Size 10 × 5, pp. 66. *Price* 3*s.* 6*d.* *Presented by H.M. Commissioner, Zomba.*

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Africa. No. 5 (1904). Agricultural Report on the District between Voi and Kiu, in the East Africa Protectorate, by Mr. A. Linton, and Return of Game shot in the Protectorate during 1903. London: Eyre & Spottiswoode, 1904. Size 13½ × 8½, pp. 12. *Price* 2*d.*

Cape Colony—Geology. ——

Cape of Good Hope. Department of Agriculture. Annual Report of the Geological Commission. Size 10½ × 6½, pp. 67. *Map. Presented by the Geological Commission.*

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A Note on the Quantities given in Dr. Marloth's Paper "On the Moisture Deposited from the South-East Clouds." By Charles M. Stewart.

Congo—Bangala Grammar. **Stapleton.**

Suggestions for a Grammar of "Bangala" (the *Lingua Franca* of the Upper Congo), with 2000 Words and many useful Phrases. By W. H. Stapleton. Yakusu: Baptist Missionary Society, 1903. Size 7 × 5, pp. 116. *Presented by Rev. G. Grenfell.*

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Comparative Handbook of Congo Languages. Compiled and prepared for the Baptist Missionary Society, London. By W. H. Stapleton. Yakusu, 1903. Size 9 × 5½, pp. xxiv. and 326. *Presented by Rev. G. Grenfell.*

A valuable contribution to Bantu philology.

Congo—Sleeping Sickness. **Handekyn.**

Missions en Chine et au Congo **16** (1904): 41–47.

Congo. La maladie du sommeil. Lettres du P. Handekyn.

Dahome—Borgu. *A travers le Monde* **10** (1904): 101–102. **Brousseau.**

Dans le Borgou (haut Dahomey). Un Pays d'avenir. Par Georges Brousseau. *Map.*

The writer thinks Borgu adapted for European settlement.

Egypt. **Fenn.**

The Khedive's Country, the Nile Valley and its Products. Edited by G. Manville Fenn. London: Cassell & Co., 1904. Size 8½ × 6, pp. 180. *Illustrations. Presented by the Publishers.*

Deals chiefly with agricultural resources and operations in the Nile valley, on the basis of information supplied by Mr. Thomas Wright, superintendent of the Khedive's agricultural estates near Cairo, and thus of some practical value.

Egypt—Irrigation. **Barois.**

Les Irrigations en Égypte. Par Julien Barois. Paris: C. Béranger, 1904. Size 11½ × 8, pp. iv. and 386. *Maps, Plans, and Illustrations.*

The author, now French director of the Egyptian State railways, brought out a work on the same subject in 1887, but the immense recent advances in irrigation matters has necessitated the re-writing of the book. It forms a useful summary of the facts and principles of the subject in its present stage.

Eritrea. **Rossini.**

L'Esploraz. Com. **18** (1903): 241–251, 276–281, 297–303, 325–327, 340–342; **19** (1904): 5–8, 20–24, 37–42, 51–56, 72–74, 112–122.

Al Rágali. C. Conti Rossini. *With Map.*

Detailed observations on the northern part of the Danakil country and its inhabitants.

French Sahara—Tuat. *Rev. G.* **28** (1904): 108-118. ——

Le Touat. Par un officier des compagnies sahariennes. *With Map and Illustrations.*

German South-West Africa. *Deuts. Kolonialblatt* **15** (1904): 192-195, 207-221. ——

Der Herero-Aufstand in Deutsch-Südwestafrika.

German South-West Africa. **Seiner.**

Bergtouren und Steppenfahrten im Hererolande. Von Franz Seiner. Berlin: W. Süsserott, 1904. Size 9½ × 6, pp. 278. *Map and Illustrations. Price 5s. 6d.*

See review in June number.

Gold Coast. ——

The Gold Coast Civil Service List (1903), showing the Civil Establishments, Names and Designations of the Civil Servants of Government, etc. London: [E. Stanford], 1903. Size 10 × 6½, pp. 422. *Map. Price 10s. net. Presented by the Publisher.*

Gulf of Guinea. *Ann. Hydrographie* **32** (1904): 209-221. **Wendt.**

Meeresströmungen im Golf von Guinea. Von Dr. E. Wendt.

Komoro Islands. *Rev. Colon.* (1904): 515-548. **Plantier.**

La Grande-Comore; sa colonisation. Par le Dr. Nicolas du Plantier.

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Der Nyassasee. Von Kapitän M. Prager. *With Maps and Illustrations.*

Madagascar. ——

Guide-Annuaire de Madagascar et Dépendances. Année 1904. Tananarive, 1904. Size 9 × 6, pp. x. and 858. *Maps. Presented by General Gallieni.*

Madagascar. *La G., B.S.G. Paris* **9** (1904): 241-248. ——

Les travaux géodésiques, topographiques et cartographiques exécutés à Madagascar en 1902 et 1903. *With Map.*

Madagascar. *C. Rd.* **138** (1904): 1076-1079. **Colin.**

Travaux géodésiques et magnétiques aux environs de Tananarive. Note du P. Colin. *Diagram.*

Madagascar—Language. *J. Asiatique* **2** (1903): 451-485. **Ferrand.**

L'élément arabe et souahili en malgache ancien et moderne. Par G. Ferrand.

Morocco. *Tour du Monde* **10** (1904): 37-60. **Kann.**

A travers le Maroc révolté. Par R. Kann. *With Illustrations.*

Morocco. **Weisgerber.**

Dr. F. Weisgerber. Trois mois de campagne au Maroc. Étude géographique de la région parcourue. Paris: E. Leroux, 1904. Size 9½ × 6, pp. 240. *Maps and Illustrations. Price 5 fr. Presented by the Author.*

Nigeria. *B.S.G. Rochefort* **25** (1903): 213-234. **Figeac.**

Peuplement du Bassin du Moyen-Niger par des envahisseurs de race blanche venus du Nord-Est. Par T. Figeac.

NORTH AMERICA.

Alaska. *B. American G.S.* **36** (1904): 65-80. **Lansing.**

The Questions settled by the Award of the Alaskan Boundary Tribunal. By R. Lansing. *With Map.*

Alaska—Boundary. ——

Alaskan Boundary Tribunal. The Argument of the United States before the Tribunal convened at London under the provisions of the Treaty between the United States of America and Great Britain concluded January 24, 1903. (Pp. vi., 204, and 18).—The Case of the United States (pp. 550).—The Counter Case (pp. 290). Washington, 1903. Size 9½ × 6. *Two Atlases (separate).* Size 18 × 15. *Presented by the United States Embassy.*

Alaska—Mount McKinley. *J.G.* **2** (1903): 441-469. **Brooks.**

An Exploration to Mount McKinley, America's Highest Mountain. By Alfred H. Brooks. *Map and Illustrations.*

Account of the expedition of 1902 (cf. *Journal*, vol. xxi. p. 459).

Canada—Altitudes. **White.**

Dictionary of Altitudes in the Dominion of Canada, with a Relief Map of Canada.

By James White. Ottawa, 1903. Size 10 × 7, pp. x. and 144. *Presented by the Canadian Government.*

Mexico. **Pimentel.**

Obras completas de D. Francisco Pimentel. Publícanlas parar honra la memoria del autor sus hijos, Jacinto y Fernando. 5 vols. Mexico: Tipografia Económica, 1903–1904. Size 10½ × 7, pp. (vol. i.) cx. and 510; (vol. ii.) 614; (vol. iii.) 544; (vol. iv.) 576; (vol. v.) 516. *Portrait. Presented by the Sociedad Mexicana de Geografia y Estadistica.*

Includes many papers on the peoples and languages of Mexico, studies in political economy and on Mexican writers and literature.

North America—Early Travels. **Thwaites.**

Early Western Travels, 1748–1846. A Series of Annotated Reprints of some of the best and rarest contemporary volumes of travel, descriptive of the Aborigines and Social and Economic Conditions in the Middle and Far West, during the Period of Early American Settlement. Edited with Notes, Introductions, Index, etc., by R. G. Thwaites. Vol. i. Journals of Conrad Weiser (1748), George Croghan (1750–1765), Christian Frederick Post (1758), and Thomas Morris (1764). Cleveland, Ohio: The Arthur H. Clark Co., 1904. Size 9½ × 6½, pp. 328. *Portrait.*

This series is to be completed in thirty-one vols.

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Annual Reports of the War Department for the Fiscal Year ended June 30, 1903. Vols. ix.-xiii. (Report of the Chief of Engineers, Parts i.–iv. and Supplement.) Washington, 1903. Size 9¼ × 6, pp. 3012 (supplement 318). *Maps, Plans, and Illustrations. Presented by the Engineer Department, United States Army.*

United States—California—Hydrography. **Lippincott.**

California Hydrography. By J. B. Lippincott. (United States Geological Survey, Water-Supply and Irrigation Paper No. 81.) Washington, 1903. Size 9¼ × 6, pp. 488. *Maps.*

United States—Cape Ann—Geology. **Tarr and Woodworth.**
B. Mus. Compar. Zool. **42** (*Geol. Ser.* **6**) (1903): 181–196.

Post-glacial and Interglacial (?) Changes of Level at Cape Ann, Massachusetts. By R. S. Tarr. With Note on the Elevated Beaches, by J. B. Woodworth. *Thirteen Plates.*

United States—Ethnology. **Powell.**

Twentieth Annual Report of the Bureau of American Ethnology to the Secretary of the Smithsonian Institution, 1898–99. By J. W. Powell. Washington, 1903. Size 11½ × 8, pp. ccxxiv. and 238. *Plates. Presented by the Bureau of American Ethnology.*

The bulk of the report consists of a monograph on aboriginal pottery in the Eastern United States.

United States—Hydrology. **Rafter.**

The relation of Rainfall to Run-off. By G. W. Rafter. (United States Geological Survey Water-Supply and Irrigation Paper No. 80.) Washington, 1903. Size 9¼ × 6, pp. 104. *Diagrams.*

United States—Illinois. *B. American G.S.* **36** (1904): 145–157. **Hubbard.**

A Case of Geographic Influence upon Human Affairs. By G. D. Hubbard. *With Maps.*

Discusses the influence of past glaciation on the life (vegetable, animal, and especially human) of Wisconsin.

United States—Maryland. *American Science* **17** (1904): 141–159. **Mathews.**

The Structure of the Piedmont Plateau as shown in Maryland. By Edward Bennett Mathews. *Map.*

United States—Meteorology. *Monthly Weather Rev.* **31** (1904): 625–652. ———

Annual Summary, 1903. Report of the Chief of the Weather Bureau for the fiscal year ending June 30, 1903. *With Charts.*

United States—Mississippi. *J. Franklin I.* **157** (1904): 381–389. **Meerten and Haupt.**

Controlling the Floods of the Mississippi. By H. van Meerten and L. M. Haupt.

United States—New York. *American J. Sci.* **17** (1904): 333–346. **Tuttle.**

Recent Changes in the Elevation of Land and Sea in the Vicinity of New York City. By G. W. Tuttle. *With Diagram.*

United States—Petroleum. **Montague.**
The Rise and Progress of the Standard Oil Company. By G. H. Montague. New York and London: Harper & Bros., 1904. Size 8 × 5, pp. vi. and 144. *Price* $1.00 *net. Presented by the Publishers.*

CENTRAL AND SOUTH AMERICA.

Bolivia—Chuquisaca. ——
Sociedad Geográfica Sucre. Diccionario geográfico del Departamento de Chuquisaca. Contiene datos geográficos, históricos y estadísticos. Sucre, 1903. Size 9 × 6½, pp. xiv. and 372. *Presented by the Oficina Nacional de Immigracion, etc., La Paz.*

Brazil. *Meteorolog. Z.* **21** (1904): 169–175. **Draenert.**
Das Klima von Blumenau im Staate Santa Catharina, Brasilien. Von Prof. F. M. Draenert.

Brazil—Cartography. *Science* **19** (1904): 681–694. **Derby.**
The North-East Coast of Brazil in Ancient Cartography. By Dr. O. A. Derby. *With Maps.*

Noticed in the Monthly Record, *ante*, p. 227.

Brazil—Historical. **Edmundson.**
The Dutch on the Amazon and Negro in the Seventeenth Century. By George Edmundson. (Reprinted from the *English Historical Review*, October, 1903.) Size 10 × 6, pp. 22. [See p. 227.]

Brazil—Purus. *Annual Rep. Smithsonian I.* (1901): 359–393. **Steere.**
Narrative of a Visit to Indian Tribes of the Purus River, Brazil. By Joseph Beal Steere. *Plates.*

Brazil and Bolivia—Acre. **Deheza.**
La Cuestión del Acre. Por José A. Deheza. Sucre, 1903. Size 7½ × 4½, pp. 108. *Map.*

Costa Rica—Antiquities. *Globus* **85** (1904): 233–239. **Seler.**
Archæologische Untersuchungen in Costarica. Von Dr. Ed. Seler. *Illustrations.*

Ecuador. *C. Rd.* **138** (1904): 1013–1019. **Poincaré.**
Rapport présenté au nom de la Commission chargée du contrôle scientifique des opérations géodésiques de l'Équateur. Par H. Poincaré.

Noticed in the Monthly Record for July (p. 98).

Ecuador—Andes. *Globus* **85** (1904): 149–157. **Meyer.**
Die Gegenwärtigen Schnee- und Eisverhältnisse in den Anden von Ecuador. Von Prof. Hans Meyer. *Illustrations.*

Honduras. *B.S.R.G. d'Anvers* **28** (1904): 39–84. **Jalhay.**
Notice sur les mines d'or et d'argent de la République de Honduras. Par H. Jalhay.

Mexico—Popocatepetl. *A travers le Monde* **10** (1904): 9–11, 29–30. **Laroussie.**
Une Ascension du Popocatepetl. Par J. C. Laroussie. *With Illustrations.*

Panama. *Deuts. Rundschau G.* **26** (1904): 177–179. ——
Die Republik Panama. *Map.*

Panama. *Nat. G. Mag.* **15** (1904): 57–73. **Burr.**
The Republic of Panama. By W. H. Burr. *Illustrations.*

Panama Canal. *National G. Mag.* **15** (1904): 167–176. **Page.**
The Sailing Ship and the Panama Canal. By James Page. *With Diagrams.*

Peru. **Torres.**
El Istmo de Fitz-Carrald. Informe presentado á la Junta de Vias Fluviales por el Ingeniero Juan M. Torres. Lima, 1903. Size 8½ × 6½, pp. x. and 404.

This report appeared in the publication of the Junta de Vias Fluviales, lately noticed in the *Journal* (vol. xxiii. p. 604).

Peru—Huayabamba. *B.S.G. Lima* **13** (1903): 295–309. **Calderon.**
La via fluvial del Huayabamba. Por Germán Torres Calderón. *Map.*

St. Vincent and Martinique. **Anderson and Flett.**
Report on the Eruptions of the Soufrière, in St. Vincent, in 1902, and on a Visit

to Montagne Pelée, in Martinique. Part i. By Dr. Tempest Anderson and Dr. J. S. Flett. (*Philosophical Transactions of the Royal Society of London*, Series A, vol. 200, pp. 353–553.) London: Dulau & Co., 1903. Size 12 × 9. *Map and Plates. Price* 15*s.* 6*d.*

Salvador. **Guzmán.**
An. Museo Nac. San Salvador **1** (1903): 22–27, 103–107, 161–165, 184–195.
Geològia de El Salvador. D. J. Guzmán.

South America—Aimará Language. **Escobari.**
Silabario Aimará. Con la Ortologia propria de esta lengua y del Quichua. Por Macario D. Escobari. La Paz, 1903. Size 7½ × 4½, pp. 38.

West Indies—Bahamas. ——
General Descriptive Report on Bahamas Islands, including Annual Report for 1902. Size 13 × 8½, pp. 61. *Map and Illustrations. Price* 1*s.* 2*d.*

AUSTRALASIA AND PACIFIC ISLANDS.

New Guinea—Dutch. **Dissel.**
Tijds. K. Ned. Aardr. Genoots. Amsterdam **21** (1904): 478–517.
Landreis van Fakfak naar Sekar. Door J. S. A. van Dissel. *With Map.*

Journey in the peninsula to the south of McCluer gulf.

New Guinea—Dutch. *Tijds. K. Nederl. Aardr. Genoots.* **21** (1904): 339–355. **Ijzerman.**
Mededeelingen omtrent eene Ontworpen Expeditie naar de Binnenlanden van Nieuw-Guinea. Door J. W. Ijzerman. *Map.*

Discusses the aims and methods of an expedition which is being organized for the exploration of the great mountain range of the interior of Dutch New Guinea, proof of the occasional presence of snow on which has lately been obtained. The map shows the results of a recent survey of part of the south coast.

New Guinea—Dutch. **Niermeyer.**
Tijds. K. Nederl. Aardr. Genoots. **21** (1904): 355–364.
Over de Expeditie Wichmann in Nieuw-Guinea. Door J. F. Niermeyer.

Cf. note in *Journal* for January, 1904, p. 130.

New South Wales. **Coghlan.**
Picturesque New South Wales. An Illustrated Guide for Settler and Tourist. T. A. Coghlan. [Sydney, 1903.] Size 10 × 7½, pp. viii. and 210. *Maps and Illustrations. Presented by the Agent-General for New South Wales.*

POLAR REGIONS.

Antarctic—Meteorology. **Arçtowski.**
Aperçu des résultats météorologiques de l'hivernage Antarctique de la *Belgica*. Par H. Arçtowski. Bruxelles, 1904. Size 7½ × 5, pp. 42. *Diagram.*

Antarctic—Swedish Expedition. **Nordenskjöld, Andersson, and Larsen.**
Ymer **24** (1904): 43–86.
Den svenska sydpolar expeditionen 1901–03.—I. Allmän öfversikt samt redogörelse för vinterstationen vid Snow Hill. Af Otto Nordenskjöld. *With Map and Illustrations.* II. De vetenskapliga arbetena ombord på Antarctic sommaren 1902–1903 och slädfärden till Snow Hill 1903. Af J. G. Andersson. *With Illustrations.* III. Antarctics sidste færd. Af C. A. Larsen. *With Illustrations.*

Arctic—Hydrography. *Iz. Imp. Russian G.S.* **39** (1903): 338–361. **Varnek.**
Review of the work of the Arctic Hydrographic Expedition in 1902. By A. T. Varnek. *Maps.* [In Russian.]

Arctic—Spitzbergen. *S.G. Italiana* **5** (1904): 232–235. ——
Ascensione della vetta "Savoia" nelle Spitzberghe. Por Lorenzo Bertolin. *Illustrations.*

MATHEMATICAL GEOGRAPHY.

Cartography—Map Collection. **James.**
Tijds. K. Nederl. Aardr. Genoots. **21** (1904): 368–373.
Museum Geographicum Bodellianum. Door O. G. James.

On the Bodel collection of maps at Leyden.

Geodesy. **Bakhuyzen.**
Comptes rendus des séances de la Quartorzième Conférence Générale de l'Association Géodésique Internationale réunie à Copenhague du 4 au 13 Août 1903. Rédigés par le Secrétaire perpétuel H. G. Van de Sande Bakhuyzen. 1$^{\text{er}}$ volume: Procès-verbaux et rapports des Délégués sur les travaux géodésiques accomplis dans leurs pays. Berlin: G. Reimer, 1904. Size 12 × 9½, pp. 258. *Maps.*

Longitude Determination. *C. Rd.* 138 (1904): 1027–1030. **Ditisheim.**
Essai d'une détermination de différence de longitude par transport de l'heure. Note de P. Ditisheim.

Nautical Almanac. ———
The Nautical Almanac and Astronomical Ephemeris for the year 1907. Edinburgh, 1904. Size 9½ × 6, pp. 605 and 45. (Also Part i. separately.)

Position Determination. *B. American G.S.* 36 (1904): 138–142. **Littlehales.**
Concerning Sextant Observations for determining Geographical positions. By G. W. Littlehales.

Shape of the Earth. *J.G.* 2 (1903): 481–486, 521–527. **Moulton.**
The Shape of the Earth. By Forest R. Moulton.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Climate and Life. *B. American G.S.* 36 (1904): 142–145. **Wieland.**
Polar Climate in time the Major Factor in the Evolution of Plants and Animals. Abstract of a paper by G. R. Wieland.

Hydrology. *C. Rd.* 138 (1904): 1030–1032. **Maillet.**
Sur les décrues des rivières. Note de E. Maillet.

Limnology—Seiches. **Halbfass.**
Stehende Seespiegelschwankungen (Seiches) im Madüsee in Pommern. Von Wilhelm Halbfass.

Meteorology. *B. American G.S.* 36 (1904): 129–138. **Ward.**
"Sensible Temperatures." By R. De C. Ward.

Meteorology. *Quarterly J.R. Meteorolog. S.* 30 (1904): 105–122. **Wilson-Barker.**
The Present Position of Ocean Meteorology. By Commander D. Wilson-Barker. *With Charts.*

Contains a full bibliography of the subject from 1886 to 1903.

Meteorology—Air-currents. *Monthly Weather Rev.* 32 (1904): 15–20. **Bigelow.**
Studies on the Circulation of the Atmospheres of the Sun and of the Earth. By Prof. F. H. Bigelow. III. The Problem of the General Circulation of the Atmosphere of the Earth.

Meteorology—Lake winds. *Globus* 85 (1904): 246–247. **Krebs.**
Boraartige Fallwinde an Gebirgsseen. Von Wilhelm Krebs. *Illustration.*

Meteorology—Mountain winds. **Hann.**
Sitzb. Kais. A.W., Mathem.-Naturw. Classe 111 (1902): 1615–1711.
Ueber die tägliche Drehung der Mittleren Windrichtung u. ueber eine Oscillation der Luftmassen von halbtägiger Periode auf Berggipfeln von 2 bis 4 km. Seehöhe. Von J. Hann. Textfiguren.

Natural Features. *Z. Ges. Erdk. Berlin* (1904): 194–203. **Conwentz.**
Schutz der natürlichen Landschaft, ihrer Pflanzen- und Tierwelt. Von Prof. Dr. Conwentz.

Oceanography. *Ymer* 24 (1904): 94–112. **Pettersson.**
Den internationella utforskningen af de nordiska hafven. Af A. Pettersson.

Oceanography—Gascony—Coasts. *B.G. Histor. et Descrip.* (1903): 218–227. **Saint-Jours.**
Preuves de l'Antique Stabilité des Côtes de Gascogne. Par M. Saint-Jours.

Oceanography—Methods. **Knudsen.**
Conseil Internat. Explor. Mer, Publ. de Circonstance, No. 4–5 (1903): pp. 18.
Martin Knudsen. 4, Ueber den Gebrauch von Stickstoffbestimmungen in der Hydrographie. 5, Gefrierpunkttabelle für Meerwasser.

Oceanography—Tides. *Science* **19** (1904): 704–707. **Harris.**
On the feasibility of measuring tides and currents at sea. By R. A. Harris.

Physical Geography. **Spindler.**
Lectures on Physical Geography. Parts i. and ii. By Major-General J. B. von Spindler. Size 10 × 6, pp. 633. St. Petersburg, 1903. *Maps, Diagrams, and Illustrations.* [In Russian.]

Phyto-Geography. **Warming.**
Lehrbuch der ökologischen Pflanzengeographie. Eine Einführung in die Kenntnis der Pflanzenvereine. Von Dr. E. Warming. Zweite Auflage der deutschen Ausgabe übersetzt von Dr. Emil Knoblauch, bearbeitet und nach der neuesten Litteratur vervollständigt von Paul Graebner. Berlin: Gebrüder Borntraeger, 1902. Size 10 × 6½, pp. viii. and 442. *Price 7m.*

Rivers. *P.I. Civil Engineers* **154** (1903): 292–322. **Rhind.**
Empirical Formulas for finding the Maximum Discharges of Rivers. By Robert Hunter Rhind.

Sea-beaches. *P.I. Civil Engineers* **154** (1903): 46–49. **Douglass.**
Foreshore Protection and Travel of Beaches. By William Tregarthen Douglass.

Structural Geology. **Daly.**
American J. Sci. **15** (1903): 269–298; **16** (1903): 107–126.
The Mechanics of Igneous Intrusion. By R. A. Daly.

Tides. *Ann. Hydrographie* **32** (1904): 204–208. **Wegemann.**
Einfluss des Windes und Luftdrucks auf die Gezeiten. Von G. Wegemann.

Volcanoes. *Amer J. Science* **17** (1904): 253–268. **Russell.**
Criteria relating to massive-solid Volcanic Eruptions. By Israel C. Russell. *Illustrations.*

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Anthropogeography. **Demolins.**
Les grandes Routes des Peuples. Essai de Géographie sociale. Comment la route crée le type social. Par E. Demolins. Les routes de l'antiquité. Paris: Firmin-Didot et Cie, [*not dated*]. Size 7½ × 5, pp. xii. and 462. *Maps. Price* 3.50 *fr.*

The second part of this study has already been entered (vol. xxiii. p. 413).

Commercial—Cotton. **Dunstan.**
British Cotton Cultivation. Report to the Board of Trade on Cotton Cultivation in the British Empire and in Egypt. By Prof. W. Dunstan, F.R.S. London: Eyre & Spottiswoode, 1904. Size 13½ × 8½, pp. iv. and 40. *Map and Diagrams. Price* 1*s.*

Commercial—Gold. *B.S. Langued. G.* **26** (1903): 417–427; **27** (1904): 27–39. **Justice.**
L'Or: sa production, sa géographie, son rôle. Par Octave Justice.

Commercial—Petroleum. *B. Union G. Nord France* **26** (1903): 200–206. ———
La Géographie générale du Pétrole.

Ethnology—American Race. **Keane.**
Cultura de los Nativos Americanos: Su Evolución independiente. Par A. H. Keane. (From 'Anales del Museo Nacional, Segunda Epocha,' Tomo i.) Size 11½ × 8, pp. 51. *Presented by the Author.*

Historical—Chinese Travellers. **Chavanney.**
Les Voyageurs Chinois. Par Éd. Chavannes. Extrait des *Guides Madrolle:* Chine du Sud: Paris, Comité de l'Asie Française, 1904. Size 7½ × 5, pp. 24. *Map. Presented by the Author.*

Historical—Columbus. **Thacher.**
Christopher Columbus, his Life, his Work, his Remains, as revealed by original Printed and Manuscript Records, together with an Essay on Peter Martyr of Anghera and Bartolomé de las Casas, the First Historians of America. By J. B. Thacher. Vol. iii. New York: G. P. Putnam's Sons, 1904. Size 11½ × 8½, pp. viii. and 776. *Illustrations. Price* 36*s.*

Historical—Columbus and Toscanelli. **Altolaguirre.**
Cristóbal Colón y Pablo del Pozzo Toscanelli. Estudio critico del proyecto, formulado por Toscanelli y seguido por Colón, para arribar al extremo Oriente de

Asia navegando la via del Oeste. Par Angel de Altolaguirre y Duvale. Madrid, 1903. Size 11 × 8, pp. x. and 430. *Price* 15*s*.

Historical—Ferdinand Columbus. *B.R.S.G. Madrid* 46 (1904): 103–145. **Blazquez.**
El Itinerario de D. Fernando Colón y las Relaciones topográficas. Par D. A. Blazquez.

BIOGRAPHY.

Claudius Clavus. *Globus* 85 (1904): 245-246. ——
C. C. Swart, der Erste Kartograph des Nordens.

The Danish geographer Claudius Clausen Swart, better known as Claudius Clavus, was born in 1388.

Delegorgue. *B.S.G. Lille* 41 (1904): 276-278. ——
Le Tueur d'Éléphants.

Adulphe Delegorgue travelled extensively in South Africa early in the nineteenth century. It is proposed to erect a monument in his honour.

Hein. *Deuts. Rundschau* 26 (1904): 182-184. **Sieger.**
Dr. Wilhelm Hein. Von Sieger. *Portrait.*

This explorer of Southern Arabia died on November 19 last.

Herder. *Deutsch. Rundschau G.* 26 (1904): 327–329. ——
Johann Gottfried Herder. *With Portrait.*

Herder, the centenary of whose death was lately celebrated, is described as the most important forerunner of Ritter in the field of comparative geography.

Makaroff. *Ann. Hydrographie* 32 (1904): 193-195. **Schott.**
S. O. Makaroff. Von Dr. G. Schott.

GENERAL.

British Empire—Economic resources. **Dunstan.**
Imperial Institute of the United Kingdom, the Colonies, and India. Technical Reports and Scientific Papers. Edited by W. R. Dunstan. With a Preface by the late Sir F. Abel, Bart. London, 1903. Size 8½ × 5½, pp. xlviii. 378 and 236. *Map. Presented by the Imperial Institute.*

Includes a number of valuable reports on economic products of parts of the British Empire.

Educational. ——
Descriptive Catalogue (Illustrated) of Stereographs designed for use in Classes and Libraries of Public and Private Schools. Compiled by W. E. Long. New York and London, 1902. Size 9½ × 6, pp. 119.

Educational. **Cornwell.**
A School Geography. By James Cornwell. Ninetieth Edition. With numerous Revisions and Additions by Ben Jonson. Edited by J. Cornwell Round. London: Simpkin & Co., 1904. Size 7½ × 5, pp. 384. *Maps and Illustrations. Presented by the Editor.*

The attempt to bring this book into line with modern conceptions of geography has met with very partial success.

Weights and Measures. **Horta y Pardo.**
Tratado de Metrologia Universal Novisima: Medidas y pesas de todos los pueblos de la Tierra. Por el Dr. C. del Horta y Pardo. Tercera edición. Barcelona, 1904. Size 9 × 6½, pp. xii. and 228. *Plate. Presented by the Author.*

A useful work, giving the systems of weights and measures in use among all nations, and the bases of comparison between them. Some old measures are also given.

Year-book. **Haack.**
Geographen-Kalender . . . herausgegeben von Dr. H. Haack. Zweiter Jahrgang 1904–1905. Gotha: J. Perthes, 1904. Size 6½ × 4, pp. xii., 206, and 290. *Portrait and Maps.*

A considerable number of new features have been introduced into the second issue of this useful book, and improvements have been made here and there in the parts remaining the same as in the first. The two issues require to be kept together for purposes of reference, for, in order to avoid unduly swelling the bulk, certain of the data in the former volume have been omitted. The new features include tables of the Earth's dimensions in Russian measures, lists of the geographical societies, institutions, and periodicals of the world, the postal and other tariffs of the various countries, and so on. The portrait given as frontispiece is of Sir Clements Markham.

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

Bulgaria. **Military Topographical Dept., St. Petersburg.**

Russian Staff Map of Bulgaria. Scale 1 : 126,000 or 1·9 stat. mile to an inch. Sheets: vi.–2, Tirn-Radomir; vi.–3, Sofia-Orkhanie; vii.–2, Kostendil; vii.–3, Ikhtiman-Samakov. St. Petersburg: Military Topographical Department, 1903.

England and Wales. **Ordnance Survey.**

ORDNANCE SURVEY OF ENGLAND AND WALES:—Sheets published by the Director-General of the Ordnance Survey, Southampton, from June 1 to 30, 1904.

1 inch:—

(Third edition) in outline, 285, 343, 1*s*. *each* (engraved).
(Third edition) with hills in brown or black, 253, 254, 269, 343, 1*s*. *each* (engraved).
District map, with roads in colour, Winchester: encased, on paper 1*s*., or mounted on linen, 1*s*. 6*d*.

6-inch—County Maps (first revision):—

Cambridgeshire, 3 S.W. and 6 N.W. **Gloucestershire**, 71 S.E., 72 S.W. **Herefordshire**, 2 S.W., 18 N.W., 27 N.W. **Leicestershire**, 7 N.W., 30 N.E., 31 S.W., 32 S.W., 42 N.E., 43 S.W. **Radnorshire**, 5 S.W., 12 S.W., 16 S.W. **Shropshire**, 68 S.W., 77 S.W., 81 N.W. **Somersetshire**, 2 S.W., 5 S.W., 10 S.E., 14 N.W., S.E., 16 S.E., 19 N.E., S.W., 20 N.E., 21 S.W., 23 S.W., 24 S.E., 26 N.W., 29 N.W., N.E., 39 N.W., 40 N.E., 41 S.W., 45 S.W., 49 N.W., 53 N.W., 54 N.W., 65 N.W., 88 N.W., 89 N.W., N.E. **Warwickshire**, 12 S.W. 1*s*. *each*.

25-inch—County Maps (first revision):—

Brecknockshire, XVIII. 13; XXII. 2, 3, 4, 6, 7, 8, 10, 11; XXIII. 1, 5, 9, 15; XXIV. 1, 13, 14; XXIX. 2, 3, 6, 7, 10, 11, 14, 15; XXX. 1, 5, 6, 9, 10, 14; XXXV. 7, 11. **Devonshire**, II. 11, 12, 14, 15, 16; III. 6, 9, 10, 13, 14; V. 1, 5; VI. 3, 4, 8, 12; VII. 1, 2, 5, 6; VIII. 9, 10, 14; X. 1, 2, 5, 6; XIV. 3, 7, 12, 15, 16. **Herefordshire**, IX. 14, 15; XXXI. 13, 14, 15, 16; XXXII. 13; XXXIII. 16; XXXVII. 1, 2, 6, 10, 13, 14; XXXIX. 4, 10, 11; XLI. 7, 8, 11, 12, 13, 14, 15, 16; XLII. 5, 9, 13; XLIII. 6; XLV. 1, 2, 5, 13, 14, 15, 16; XLVI. 9, 13, 14, 15, 16; XLVII. 6, 11, 14; L. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 14, 15, 16; LI. 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 13, 14, 15; LII. 1, 4, 5 (11 and 15), 12, (15 and 11); LIII. 2, 4, 7, 8, 11, 12; LIV. 14. **Leicestershire**, I. 15, 16; II. 7, 11; XIV. 11; XL. 9, 13; XLVII. 1, 5; L. 13. **Lincolnshire**, CIII. 16; CXXX. 11; CXXXIX. 4, 5, 6, 7, 10; CXLVI. 1, 2, 5, 6, 7, 8, 10, 11, 12, 15, 16; CXLVIII. 6, 7, 8, 12; CL. 8; CLI. 1, 2. **Radnorshire**, XXXVIII. 4; XXXIX. 1, 5. **Rutland**, III. 10, 13; VII. 5, 6, 9, 10; IX. 2; X. 8, 11; XI. 1; XIII. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 13, 14; XIV. 1, 2; XV. 1, 2, 5. **Somersetshire**, VI. 8, 11; VII. 8, 13, 14; VIII. 5; LXIX. 13, 16; LXXVIII. 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 15, 16; LXXIX. 5, 9, 10, 11, 12, 15, 16; LXXXVI. 2, 3, 4 (5 and 9), 6, 7, 8 (9 and 5), 10, 11, 12, 14, 15. **Staffordshire**, LXXII. 6. **Suffolk**, XLIII. 1, 2, 3, 4, 5, 6, 7, 8, 11, 12, 15, 16; XLIV. 1, 3, 4, 5, 8, 12, 13, 14, 15, 16; XLV. 2, 4, 6, 9, 13; LII. 14, 15, 16; LIII. 1, 2, 5, 6, 9, 10, 13, 14; LVI. 5, 15; LVII. 2, 13, 14, 15; LVIII. 1, 3, 5, 6, 9, 13, 14, 15, 16; LIX. 1, 2, 3, 5, 6, 7, 9, 11, 12, 13, 14, 15; LX. 5, 6, 7 (8 and LXA. 5), 9, 10, 11, 12, 13, 14, 15, 16; (LXA. 5 and LX. 8); LXIX. 1, 3, 4, 8, 9, (15 and 16); LXXV. 6, 7, 8, 10, 11, 12, 14, 15, 16; LXXVI. 1. **Warwickshire**, XXX. 15. **Worcestershire**, V. 6; VIII. 1; XII. 8; XIII. 2, 5; XVI. 5, 6; XIX. 12; XX. 9, 14; XXIII. 13, 14, 15; XXX. 1, 2, 3, 5, 6, 7, 9, 10, 11. 3*s*. *each*.

(*E. Stanford, London Agent.*)

Kiel. **Mühlau.**

Neuester Plan von Kiel nebst der Vororten Hassee, Wik, Gaarden, Ellerbek, Wellingdorf, Neumühlen und Dietrichsdorf. Scale 1 : 11,000 or 5·7 inches to 1 stat. mile. Kiel: W. G. Mühlau. *Price* 60*pfg*.

ASIA.

China. **Königl. Preuss. Landes-Aufnahme.**

Karte von Ost-China. Scale 1 : 1,000,000 or 15·8 stat. miles to an inch. Sheets: Kirin, Pyöng-yang, Söul, Wladiwostok. Kartographische Abtheilung der Königl. Preuss. Landes-Aufnahme, 1904. 1.50*m*. *each sheet*.

Eastern Asia. **Imperial Topographical Institute, St. Petersburg.**

Map of Eastern Asia. Scale 1 : 4,000,000 or 63 stat. miles to an inch. 3 sheets. St. Petersburg: Imperial Topographical Institute, 1904. [In Russian.]

Eastern Asia. **Peucker.**

Uebersichtskarte von Ost-Asien. Scale 1 : 5,000,000 or 69 stat. miles to an inch. Entworfen und bearbeitet von Dr. Karl Peucker. Vienna: Artaria & Co., 1904. *Price* 1.40*m. Presented by the Publisher.*

Japan. **Japanese Imperial Geological Survey.**

Topographical Map of Japan. Scale 1 : 200,000 or 3·1 stat. miles to an inch. Sheets: Kinomoto and Nachi. Tokyo: Imperial Geological Survey, 1903. *Presented by the Imperial Geological Survey of Japan.*

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Topographical and Geological Maps of the Japanese Empire. Scale 1 : 1,000,000 or 15·8 stat. miles to an inch. Compiled by the Imperial Geological Survey of Japan. 15 sheets each. Tokyo, 1902. *Presented by the Imperial Geological Survey of Japan.*

These two maps are good specimens of the excellent cartographical work now produced in Japan. The first is a general topographical map of the Japanese Empire, carefully reduced from large survey sheets, and showing relief by horizontal lines in brown, which are extremely clear and well drawn. It is not overcrowded with names, and altogether may be considered very satisfactory. In the north-west corner there is an inset map of Japan on the scale of 1 : 5,000,000, showing heights and depths by colour tinting.

The second map shows the geological features by a carefully selected series of tints, with a clear explanation, and contains, as an inset, an interesting map of Japan, on the scale of 1 : 5,000,000, showing the distribution of volcanoes. Each volcano has a number on the map, and by reference to an adjacent list the name can be readily found. The Imperial Geological Survey of Japan has been doing good work for years past, but as many of their sheets are on too large a scale for general reference, the Department has done excellent service to geologists and geographers generally by publishing these two maps. They will be all the more useful as the lettering is in English.

Manchuria. **Königl. Preuss. Landes-Aufnahme.**

Karte des russischen Schutzgebietes auf der Halbinsel Liau-tung. Scale 1 : 200,000 at 3·1 stat. miles to an inch. Herausgegeben von der Kartographische Abtheilung der Königl. Preuss. Landes-Aufnahme, 1904. *Price* 1*m.*

Shantung. **Anz.**

Walter Anz' Reisen in Schantung, 1902–1903. Scale 1 : 1,000,000 or 15·8 stat. miles to an inch. *Petermanns Geographische Mitteilungen,* Jahrgang 1904, Tafel 8. Gotha: Justus Perthes, 1904. *Presented by the Publisher.*

AFRICA.

Africa. **Intelligence Division, War Office.**

Africa. Scale 1 : 1,000,000 or 15·8 stat. miles to an inch. Sheets: 4 (Provisional issue, without hills), North-East Morocco; 11 (Provisional issue, without hills), South-East Morocco; 83, Ngoko. *Price* 2*s. each sheet.* Scale 1 : 250,000 or 3·9 stat. miles to an inch. Sheets; Northern Nigeria (Provisional) 61—C, D, G, H, K, L, O, P. *Price* 1*s.* 6*d. each sheet.* London: Intelligence Division, War Office, 1904. *Presented by the Director of Military Operations.*

Morocco. **Roquevaire.**

Carte de Maroc, dressée et dessinée par R. de Flotte de Roquevaire. Scale 1 : 1,000,000 or 15·8 stat. miles to an inch. 4 sheets. Paris: Henry Barrère, 1904.

So many alterations and additions have been made to this well-known map of Morocco, that it would be more correct to consider the present issue as an entirely new map rather than a revised edition of an earlier one. It has, in fact, been redrawn, and is now in four sheets instead of two as before. The hill work is printed in a darker colour. Routes are shown in red, and water blue. In addition to the principal map, there are seventeen inset plans of towns.

AMERICA.

Canada. **Surveyor-General's Office, Ottawa.**

Sectional Map of Canada. Scale 1 : 190,080 or 3 stat. miles to an inch. Moose Mountain sheet (34), West of Second Meridian, revised to April 12, 1904; Swift

Current sheet (50), West of Third Meridian, revised to May 2, 1904; St. Ann sheet (87), West of Fifth Meridian, revised to May 19, 1904. Ottawa: Surveyor-General's Office, 1904. *Presented by the Surveyor-General of Canada.*

Patagonia. **Steffen.**

Tiefenkarte des Baker Fjords (Westpatagonien). Nach den Aufnahmen und Lotungen des chilenischen Kanonenboots "Magallanes" 1900, entworfen von Dr. Hans Steffen. *Petermanns Geographische Mitteilungen*, Jahrgang 1904. Tafel 9. Gotha: Justus Perthes, 1904. *Presented by the Publisher.*

AUSTRALIA.

Queensland. **Cameron.**

Sketch-map of the Walsh and Tinaroo Mineral Field. Prepared at the Geological Survey Office from the latest surveys of the Lands, Railways, and Mines Departments, under the supervision of Walter E. Cameron, B.A., Assistant Government Geologist. Scale 1 : 126,720 or 2 stat. miles to an inch. 2 sheets. Brisbane: Geological Survey Office, 1904. *Presented by the Queensland Geological Survey.*

GENERAL.

World. **Hartleben.**

A. Hartleben's Volks-Atlas enthaltend 72 Karten in Einhundert Kartenseiten. Vierte-Auflage. 1 Lieferung. Vienna and Leipzig: A. Hartleben, [1904]. *Price* 50*pf.*

This is the first part of the fourth edition of this cheap popular atlas. When complete it will consist altogether of twenty parts, containing seventy-two maps and one hundred inset plans with a full index. The maps are in colours, and printed only on one side of the paper. The price for the complete atlas is to be ten marks. This first part contains the following maps: No. 48, Servia, Bulgaria, and Macedonia; 58, South America (north part); 71, Persia, Afghanistan, and Baluchistan; 12, Atlantic Ocean, showing telegraph cables and tracks of steamers.

World. **Petrie and Schokalsky.**

Marcks' Large General Table Atlas. Edited by Prof. E. J. Petrie and Colonel J. de Schokalsky. Part 6. St. Petersburg: A. F. Marcks, 1904. [In Russian.] *Presented by the Publisher.*

This part contains sheets 11^{bis} and 12^{bis} of a general map of European Russia on the scale of 1 : 2,000,000; maps of Denmark and Scandinavia on the scale of 1 : 1,500,000, Italy on the scale of 1 : 2,750,000, and Australia and Polynesia on the scale of 1 : 27,000,000.

World. **St. Martin and Schrader.**

Atlas Universel de Géographie. Commencé par M. Vivien de St. Martin et continué par Fr. Schrader. Sheet No. 72, États-Unis. Paris: Librairie Hachette et Cie. *Price* 2*fr.* *Presented by the Publisher.*

World. **Sohr-Berghaus.**

Neue zeitgemässe Bearbeitung von Sohr-Berghaus Hand-Atlas über alle Teile der Erde. Entworfen und unter Mitwirkung von Otto Herkt herausgegeben von Prof. Dr. Alois Bludau. Früher herausgegeben von F. Handtke. Neunte Auflage. Lieferung 8. Glogau: Carl Flemming. *Price* 1*m.*

This part contains the following maps: France, sheet 3, scale 1 : 1,500,000; Spain and Portugal, scale 1 : 3,000,000; South America, sheet 2, scale 1 : 10,000,000.

CHARTS.

North Atlantic and Mediterranean. **Meteorological Office.**

Pilot Chart of the North Atlantic and Mediterranean for July, 1904. London: Meteorological Office. *Price* 6*d.* *Presented by the Meteorological Office, London.*

United States Charts. **United States Hydrographic Office.**

Pilot Chart of the North Atlantic Ocean for June, and of the North Pacific Ocean for July, 1904. U.S. Hydrographic Office, Washington, D.C., 1904. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

British Columbia. **Troup.**

Twenty-five photographs taken in Cassiar, British Columbia, by Montague Troup, Esq. *Presented by Frederick V. Longstaff, Esq.*

These excellent photographs form a welcome addition to the Society's collection, as the Cassiar district of British Columbia is still sufficiently remote to be out of the beaten paths of the ordinary traveller and photographer. The following is a list of the titles:—

(1 and 2) Panorama of Dease flat; (3) Panorama of Thibert Creek mine; (4) Monitor working, Thibert Creek; (5, 20, and 21) Two monitors working, Thibert Creek; (6) Thibert Creek, looking down creek to Dease Lake; (7) Removing boulders, Thibert Creek; (8) Home-made boat, Stickine River; (9) Mining camp, Thibert Creek; (10 and 11) Thibert Creek, 6-inch monitor; (12) Hudson Bay wharf, Dease Lake; (13) Thibert Creek; (14) Dease Creek; (15) Mouth of Dease Creek, Dease Lake; (16) Thibert Creek mine, showing flume; (17) Thibert Creek mine, showing workings; (18) Thibert Creek mine, man working monitor; (19) Dease River flat and lake; (22 and 24) Interior of mine, Thibert Creek; (23) Tal-tan Indians, Stickine River; (25) Hudson Bay store at Glenora, Stickine River.

Tibet. **Norzunoff and Tsybikoff.**

Fifty photographs of Lhasa and other places of interest in Central Tibet, taken in 1900 and 1901, on behalf of the Imperial Russian Geographical Society, by MM. O. Norzunoff and G. Tsybikoff. *Presented by the Imperial Russian Geographical Society.*

Through the courtesy of the Imperial Russian Geographical Society, the Society has been presented with this most interesting set of photographs of Lhasa, which were referred to by the President in his recent annual address, and in a note in the *Geographical Journal* for January last, whilst a selection of them was shown as lantern slides at the last meeting of the Society. A carefully written description of the photographs has been furnished by M. Grigorieff, which adds considerably to their interest.

(1) Lhasa from the east; (2) Lhasa from the north; (3) Marpo-ri with the Potala from the south-south-east; (4) Marpo-ri with the Potala from the west; (5) Potala from the south; (6) Potala from the south-south-west; (7) Potala from the east; (8) Potala from the north-north-east; (9) Potala from the west-north-west; (10) A Lhasa street during the Tsog Chod; (11) Tan-gye-ling from the south-east; (12) Gah-ldan Kansar; (13) Yutog-zampa; (14) Bar-chorten; (15) Chagpo-ri from the south-east; (16) Chagpo-ri from the north-west; (17) Kundeling from the south-east; (18) Norbulinga from the east; (19) The Amban's yamen from the south-east; (20) Chja-shi-tan; (21) General view of Sera monastery from the south; (22) The principal shrines of Sera monastery viewed from the east; (23 and 24) Purba-Chog monastery from the south-east; (25) Gechenritod; (26) Slab of stone on which the corpses of the dead are cut to pieces at Pabon-ka-ritod; (27) De-pung monastery; (28) De-pung monastery from the east; (29) Na-chun; (30) An obo; (31 and 32) Ki-chu river; (33) Ruins of Donkar-Jong castle; (34) Yamdok Tso or Palti Lake from Kamba La; (35 and 36) Yangtse Jong; (37) Tashi-lhumpo monastery from the south; (38) Tashi-lhumpo monastery; (39) Yarba-ritod; (40) Ruins of the De-chen Jong castle; (41) Gah-ldan monastery; (42) Monument erected by the present Dalai Lama near Gah-ldan monastery; (43) Sam-yas monastery from the south; (44 and 45) Sam-yas monastery; (46) Chetan from the west; (47) Tibetan woman near the Chag La; (48) Tibetan women of the lower class; (49) Tibetan women of the better class in Sunday array; (50) Domesticated yaks on pasture.

Vegetation Types. **Karsten and Schenck.**

Vegetationsbilder, herausgegeben von Dr. G. Karsten und Dr. H. Schenck. Hefts: 6, Monokotylenbäume, von Dr. G. Karsten; 7, Strandvegetation Brasiliens, von Dr. H. Schenck; 8, Merikanische Kakteen-, Agaven- und Bromeliaceen-Vegetation, von Prof. Dr. G. Karsten und Prof. Dr. E. Stahl. Zweite Reihe, Heft 1, Epiphyten des Amazonasgebietes, von E. Ule. Jena: Gustav Fischer, 1903–1904. *Price 4m. each part.*

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

GERMAN SOUTH
EXPEDITION.
DRYGALSKI.

THE GEOGRAPHICAL JOURNAL 1904.

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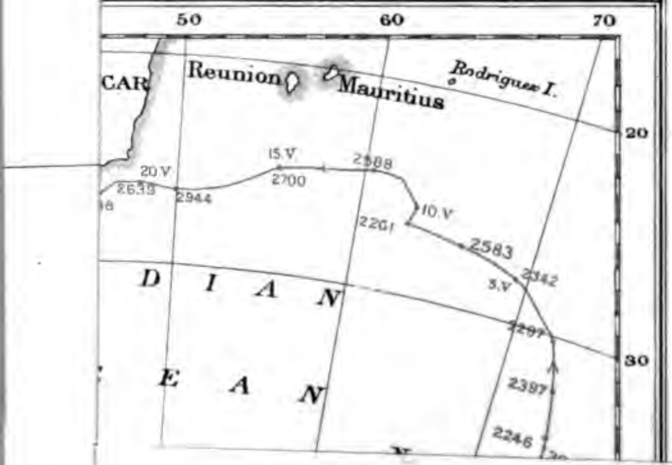

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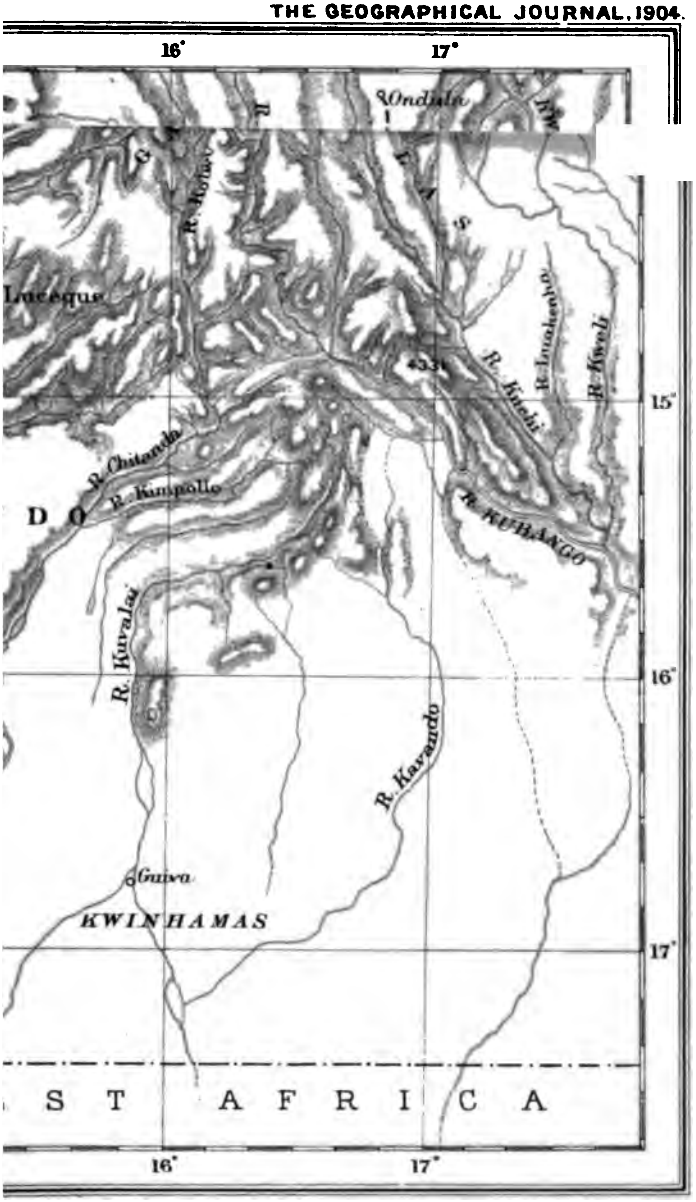

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WESTERN UGANDA.*

By Rev. A. B. FISHER.

The part of the Uganda Protectorate which I intend to deal with in this paper is that district known as the Western Province, and includes three distinct kingdoms, viz. the kingdom of Bunyoro with its king, Andareya Nziriga; the kingdom of Toro with its king, Daudi Kasagama; and the kingdom of Ankole with its king, Sulemani Kahaya. In earlier times these three kingdoms were united in or controlled by the sovereign of Bunyoro, and there is the fullest evidence of the fact that as recently as the reign of the now captive King Kabarega, the Batoro and Banyankole paid tribute to the Banyoro. The kings of Bunyoro numbered thirty-five, and it was in the reign of the ninth—King Chwa—that the Banyankole were brought under subjection. It is difficult to trace the date of the re-independence of this nation, but we find Toro remained united till the reign of Kyebambi, grandfather of Kabarega. Kyebambi gave Mwenge to one of his sons, who afterwards rebelled and ultimately succeeded in declaring Toro an independent kingdom.

In considering the ancient history of these districts under survey, we are bound to conclude that the country was well known to the earliest writers. Homer, in his map of Africa, depicts the "Mountains of the Moon;" Herodotus, in the fifth century B.C., mentions the existence of the pygmies; and Hipparchus, in 100 B.C., refers to the three inland lakes. Owing doubtless to the reverence and veneration with which the Nile was always regarded by the Egyptians, the more ardent devotees had been led to seek its source, and to thus explore these central districts. The comparative exactness with which the physical characteristics of the Nile, the Mountains of the Moon, and the lakes were described leads one to believe that this was the result of personal research rather than mere tradition. I have not the least doubt, judging from native testimony met with on all sides, that at one time there existed a great caravan route extending along the banks of the Nile for bringing away to Egypt the African spoils of ivory and slaves. Is it unreasonable imagination to suppose that King Solomon drew his vast supplies of ivory from these directions? What other country can compete with it in its magnificent tusks, many weighing 200 lbs.? Besides this, there are many distinct traces of influences of higher civilization, even among the crudest of the tribes living close to the mighty Ruwenzori mountain range.

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* Read at the Royal Geographical Society, June 13, 1904. Map, p. 376.

In the extremely delicate and diverse forms of string and basket work peculiar to the Batoro tribe, one notices marked similarity to Egyptian design. Then, again, among the tribe of the Bahuku is another suggestive point: whilst staying in their vicinity for a period of six weeks, I made a strong effort to collect together a selection of their war-horns, which consist of minute ivory tusks shaved down and scooped out. It was not an easy matter to procure them, as they are regarded as the heirlooms of the family, and have been handed down from ancient times. Offering, however, high and tempting terms in the shape of goats, I succeeded in procuring six or seven. I then found that each had its own peculiar mark: one resembled most clearly the planet Saturn, another the Pleiades, others various hieroglyphic designs. Questioning the folk as to the significant meaning of each, they expressed total ignorance beyond that they were intended for ornamentation by their early fathers. Taking into consideration the absolute ignorance and disregard of the native mind about the celestial bodies, this, to my mind, is a most unaccountable coincidence, if it does not illustrate or emphasize the point now being dealt with.

Then as regards government. If they had not modelled it after a higher example shown them, how can we account for the intricate and highly developed form of native administration which we found existing in these parts, and which the British Government was not able to improve upon for these people?

There remains still one other proof of an influence of an outside civilization, and that is in the religion of the country. As among all African tribes, the belief in general is that of devil-worship. Yet after carefully questioning the Batoro, and sifting their creed down to its foundation, it is seen that they have believed in an all-good and almighty Creator who had no beginning and can know no end; they also believe in the personality of the "king of darkness," who sends his spirits to tempt men away from good, and if allowed to be thus drawn away, they will ultimately reach his kingdom, from which there is no escape. Death, they affirm, entered the world by sin, and they have a number of legends to illustrate the fact. The ritualism of their belief savours of semitic practice, viz. propitiation by offerings in kind, or the flesh of fowls, goats, sheep, oxen, which must all be white or without blemish; and human blood. When first visiting Bunyoro in 1895, the oldest inhabitants of the country related to me how a white man and woman many years ago landed on the right bank of Lake Albert, and settled in Bunyoro. On being questioned as to whether they referred to Sir Samuel and Lady Baker, they replied that they remembered them well, and described them to me. But, said they, these other white people arrived a long, long time ago, and founded their first dynasty. The story is that this man and his wife came down from the Nile, and caused a great sensation, the people all flocking round them, exclaiming, "Kintu ki?" ("What is it?") So they named the man Kintu. He soon won the devotion of the Banyoro by his hunting prowess, and they made him their king. About 1892, a story, that had its origin among the tomb-keepers of a king, said to have been known as Kintu, aroused such curiosity among the intelligent Baganda that they made a search for a book, which was reported had been buried with him. Although this proved futile, the people do not discredit the story, knowing the powers of the white ants in their country to finish off anything of value. They still hold one day out of the seven as sacred, which they had been taught by Kintu.

SEMLIKI RIVER, MIDWAY BETWEEN LAKE ALBERT AND ALBERT EDWARD.

The Batoro tell of how a white man came down from the north and settled among them and reigned over them. As a proof of their statement, they will point to the sprinkling of very light brown colouring of the skin of many of their numbers.

The predominant and most striking physical feature of this entire district is, of course, the range of mountains known as the Mountains of the Moon. I have made very thorough investigations among the various tribes as to the possible origin of the word "Ruwenzori," and invariably found that speaking of the mountain as a whole is quite unknown to them. Each peak has its own appellation, and the nearest approaches to the word that have been given to me are "Rwensozi," which means "the mountain of mountains," and "Rwenseri," meaning "the mountain over there" (the direction referred to). It is most frequently called Birika, the only word I have heard used for "snow" among all the mountain folk. The Baganda call it "Gambalagala fumba biri," which is "the leaf that cooks the clouds." This refers to their custom of cooking all their food in banana leaves. As the mists sweep down the mountain-sides, they declare it is the smoke from the "cooking-pot."

I fully endorse Sir Harry Johnston's estimate of the approximate height of the highest peak reaching an altitude of between 20,000 to 22,000 feet. When, with Mrs. Fisher, who is the first and only lady who has reached Ruwenzori's ice, we climbed to the point which Sir Harry Johnston arrived at, I noted that my glass fell from 115° Fahr. to 28° Fahr., from an altitude of 5000 feet to 13,800 feet.

From the base to the snow-line is five days' most arduous climbing, and is attended with considerable danger. For the first 8000 feet one is pushing his way up the sides of forest-covered ridges, where ferns of every variety are found, from the male fern to the Australian tree-fern. Maidenhair shrubs, orchids, gigantic lobelias of two distinct species, are the prevailing plants. Bird and insect life from this point apparently ceased, and nothing broke the unutterable silence save the occasional rush of a glacier stream, or the thunder that crashed and roared from peak to peak. Camping space is very limited. On four days there was only room for one tent to be pitched in a very flabby manner under protruding rocks, and a slight deviation from the narrow path would have landed one some hundreds of feet below, for most of the time we were travelling along the top of a ridge which rose as an eye-tooth from river-beds. Beyond this altitude stretched bamboo forests, which terminated in thick morass and swamp, continually fed by waterfalls and streams flowing from the face of a precipitous rock. The unpleasant ordeal of plunging through this for some hours in the early morning, and the desperate climb up the almost perpendicular rock, will not soon fade from our memory. The next day's ascent was over slippery heather trunks that had fallen across tree-tops; this brought us to a swampy valley filled with 4 to 5 inches of water and soft moss. On every side water was trickling down into it from the melting snows above. From this to the Mubuku glacier was steep climbing through loose earth covering rock, fresh-fallen snow, and over frozen puddles. We had to haul ourselves up by means of ropes over the last bare and hanging rocks, and then we were rewarded by a glorious vision of the mighty equatorial glacier which was overpowering in its magnificence.

My conviction is that those of us who have undertaken the task have made a mistake in not attacking it from its western flanks. During a more recent stay in Mboga, when I was able to compare the position with that from the eastern side, the whole panorama of snow-peaks appeared distinctly for many days. I believe no attempt has yet been made to approach it from this side, perhaps for the reason that travellers have not made Mboga a popular field for exploration, and those few who have passed through the district may have been cheated from a view of the snows by the clouds and mists that hang so heavily on the mountain-sides as a general rule. The late Sir Henry Stanley drew attention to this hazy obstacle when seeking for a reason for the silence of his predecessors on the subject of Ruwenzori's snows.

PAULO TABALO, CHRISTIAN CHIEF OF MBOGA, BEYOND SEMLIKI.

Reaching a higher point than the Mbuku glacier from the right will always be a tremendous difficulty, and one that will involve the sacrifice of human life. Even if one's porters are chosen from the hardy mountain folk, the Bakonjo—which was the plan we adopted, and so suffered no cases of death among our caravan during those days of intense hardship and indescribable cold—we found the natives totally unfit to endure the climatic changes for any protracted period, which must be involved if a higher point than that already reached is to be attained. My conviction is that the left-hand route would be less circuitous, and would bring one in closer touch with the highest peaks.

The whole of Toro has been subjected to tremendous volcanic action. A chain of extinct volcanoes extends from north to south, and these point to a very remote period of activity; in the craters of several are to be seen lakes, and dense vegetation growing up the sides. The people of the country have no knowledge of the true nature of these hills, tradition has suffered, like all their ancient history, from having nothing beyond verbal channels. They will tell you that these craters are the dwelling-places of the witches or evil spirits. "Kaitabaloga," which means "that which kills the witches," is the name given to them, and whenever a witch had been found, she was thrown into these craters, whence they were supposed to have come. The evil spirits are reputed to have swallowed up men and cattle; whether or no this is a contortion of the actual truth or pure legend, it is impossible to say. A tribe called Bachwezi is said to have inhabited Toro in early times, and to have suddenly and entirely disappeared, and it is a curious fact that the word used for evil spirits is "Bachwezi," and although the people do not seem to associate the *tribe* Bachwezi, as they do the evil spirits, with these craters, one is inclined to question whether there is not here a clue to the destructive forces which must once have swept away all form of life.

On account of Ruwenzori, Toro stands pre-eminently unique as regards the water system and supply when compared with other districts. An old Arab historian named El Makrisi went so far as to declare that the four rivers Gihon, Sihon, Euphrates, and the Nile had a common origin in these mountains, which were in the region of Paradise. I can only say, from my experience of six years' life in Paradise, that the Garden of Eden must have sadly deteriorated, and there is little left beyond morasses and elephant grass of gigantic growth that would be more in keeping with the mammoth epoch.

I, however, agree with him in attributing the source of the Nile to these snow mountains. From the glaciers descend innumerable streams, which grow into wild cataracts that, tumbling down over rocks and boulders, reach the plains, and, passing through the country as clear crystal streams, empty themselves into the lakes. But in addition to this supply, the mountains attract all the rain-clouds; the force of gravitation is so great that with a mighty roar the winds from all the four quarters will, as it were, rush together, and then sweep on to the mountains, where, smashing up with a tremendous concussion, they will rebound and pour down their fury on the country of Toro. This occurs more or less for nine months out of the twelve. Bunyoro, on the other hand, offers sharp contrast; the whole district is a stretch of cone-shaped hills, occasionally relieved by a saddle-back, and contains part of that curious rift-valley called by Emin Pasha "the ribbon." This hilly condition has a deteriorating effect on the water-supply. The rains begin in March, and continue till the end of May; then follows three months' dry season. The rains accumulate at the base of these hills, and are thwarted in their effort to form a channel, owing to the barrier offered by the rapid-growing vegetation. Being thus checked, the water expands, and, with the alluvial deposits washed down, settles itself into stagnant swamps, through which the earlier traveller had to wade, the natives not considering bridges essential.

CROSSING THE MUBUKU RIVER.

The district of Bugoma in Bunyoro was until 1895 considered a dense forest extending to the Albert lake; but during a short visit to the district, I proved by entering it, that it was only a crescent-shaped belt about 2 miles deep, with its ends resting on the lake and nestling in a well-protected valley. It contains excellent timber, and rubber vines of an inferior quality.

I must not overlook that splendid river known as the Semliki, which unites the Albert Edward and Albert lakes. It lies on the western side of Ruwenzori, and is in close proximity to the great Congo forest. There is no reason why this should not be utilized as a waterway for floating down the heavy timber and the quantities of rubber from the forest, which is at present untouched. With the exception of a small cataract about the middle of its course, there is nothing to check its cargo reaching the Albert lake, where the lake steamers could take it on. The rapidity of its flow prevents sud from accumulating. If the boundary of the British and Belgian territory is yet awaiting demarcation, I would strongly urge the importance of holding the monopoly of this central African waterway.

Observing the flat levelness of the Semliki plain, and the ridges of hills and rocks that enclose it, one would be led to suppose that the Albert lake once covered a much larger stretch of land; the cataract of the Semliki river, above referred to, might have marked its southern boundary, if it did not actually extend to and join up the Albert Edward lake. The country from Busaiga to the plain is rather remarkable. On reaching Busaiga from Toro, the land suddenly drops some 500 feet, and what appears to be a vast plain extends for a distance of some 15 miles. On descending to it, however, it is found to be a slightly undulating plateau with long intercepted parallel strata of rock, which have the appearance of railway embankments. The soil is very sandy, and sprinkled with quantities of small shells such as are found on the lake-shores. To reach the Semliki plain, one has to again abruptly descend another 400 feet.

The natural resources of the districts are partially or entirely undeveloped. Ankole might be called the ranchland of the Uganda Protectorate. There extends mile after mile of the richest pasture, and the cattle are exceptionally fine. They consist of the long-horned and hump species, and the cows give a particularly rich milk; the goats and sheep excel those of other districts, and are very numerous. The Batoro and Banyoro have neglected the cultivation of their country. They certainly are not epicureans, and are quite content to feed on a small millet called "bura" year in and year out, as it grows with very little expenditure of toil, although it contains practically no nutritive quality. The soil is particularly rich, but the excessive waterfall in Toro, and the intense strength of the sun, have the effect of forcing everything to exaggeration, and robbing all vegetation of the more delicate touches of nature in regard to general growth, colouring, and flavour. Almost anything planted will grow, and, the year having only one season, a constant crop of fruit, vegetables, and flowers can be obtained. In Toro strawberries can be had for nine months out of the twelve, and green peas, cauliflowers, potatoes, beans, marrows, etc., all the year round. This should be the colony for vegetarians, for while you can have fifteen different vegetables served up at one meal, as my cook has often treated me to, there is little temptation to have recourse to the tasteless chicken or the not-too-tender goat's meat.

On the slopes of Ruwenzori, tea could be most successfully grown; the coffee is of exceptionally fine flavour, and the marshy character of the country should make it valuable for rice-fields. In the Semliki plain, which at present is one vast stretch of waste land, I have met with specimens of cotton which is much superior to other kinds produced in the Protectorate. The present hindrance to aggressive industries is the difficulty of transport. As the native is at present compelled to carry his goods a distance of 179 miles into Uganda if he wants to find a purchaser, there is little to encourage the people to work the land beyond providing for their own needs.

The rubber industry is absolutely untouched, and in all the forests of these provinces there is a considerable quantity. The whole country must at one time have been more thickly wooded than at present. In a district where the traveller meets with a number of large shady trees, shambas are to be found, and depend upon it, if you question the oldest inhabitant as to how the trees came there, the answer will be "Twagalonda," that is, "we selected them"—referring to the period when the district was covered with forest, and, in search of new and rich soil for their crops, they had gradually felled down superfluous trees. The fact is that isolated trees do not exist, because they have been unable to resist the annual grass fires, and even where they did manage to grow to maturity, they were then swept down by the hurricanes. The flowers have suffered in the same manner, which accounts for the marked scarcity in the country.

As regards the mineral wealth, the recent syndicate is said to have found nothing of workable value, but I cannot refrain from expressing an opinion that the river-beds, which are the tracks of the swift glacial streams, might well repay a prospector. They lie off the route taken by those who travelled through the country for this purpose.

The reason one never comes across old and well-fortified cities, as in Nigeria, is that the custom has prevailed among all the tribes of the Protectorate to change the capital with each succeeding king, and even he may change it again if the fit seizes him to move on. As all their buildings were composed of reeds and thatch, and their fences of rushes, there was no durable substance in their towns. Thus it is there remains nothing to denote the sites of their ancient capitals, beyond a few cooking-stones or slabs which had been used for grinding up their millet.

Animal life, bird life, and insect life abound in the Western Province, especially in the Semliki valley. I have seen six specimens of antelope in the Mboga district. Elephants perambulate in herds of fifty to one hundred and fifty; each herd has its advance and rear guards, which sound the alarm on the approach of an enemy. Leopards and lions are numerous; the former only trouble the inhabitants. In Toro large specimens are found; one of those I shot in that district measured 9 feet from the tail-tip to the nose. In quest of a specimen of the okapi, I was always met with the reply that they were such fierce creatures that capture was impossible. However, I have no doubt we shall soon procure a living specimen, and thus learn more definite information about its traits.

The district contains a heterogeneous collection of tribes, each with its distinguishing feature and customs. The Banyoro are the parent stock of the Baganda, Batoro, and the Bairu of Ankole. The Baganda appear to be the earliest offshoot, then the Bairu, and finally the Batoro in the reign of Kyebambi. The race has deteriorated owing to a virulent form of syphilis introduced by traders and Arabs, who have come down in large numbers from the Nile. Naturally, they possessed strong warlike instincts, but these have been crushed by the superiority of their near neighbours the Baganda. Mental freedom has been denied them by the predominant power of the devil priestcraft. In Uganda the priests always interpreted along the line of popular opinion, but in Bunyoro they had adopted the opposite plan, which had the effect of crushing independent thought and action.

The priests alone were allowed to consult with the great devil, and that through his angels, who numbered ten—Nyabuzana, Kyomya, Kagolo, Mulindwa, Ndaura, Ebona, Mugenye, Mukasa, Lubanga, and Namutali. The angels would refuse to respond unless the priest donned the crown that was peculiar to that particular deity. The demands of their belief were fourfold—human sacrifice, branding, cutting with sharp knives, and the extraction of the teeth in the lower jaw—and these were practised on every occasion of family or community trouble or sickness. A child was once brought to me with a deep wound in her forehead, caused by the mother shooting a blunt arrow at the child's head, that she might draw the blood and relieve the pain by thus expelling the evil spirit.

The Batoro have become much influenced by the physical conditions of their adopted country, as is the case with all the tribes met with in the region of the mountains. Shut in by the great mountain barrier and lying off the caravan routes, the people have become insular and their minds cramped. The terrible demands of the ritualism of their belief, namely, cupping, which was practised from infancy and continued to old age, have seriously sapped the life of the nation, and taken from the people the power and muscular energy to master their very assertive and productive soil. The consequence is that the country is very unkempt, and they own it rules them. But being convinced, does not determine them to readjust things. Then, again, the air is charged with so much electricity on account of constant thunderstorms, that this has had the effect of numbing the mental vigour and will-power of the people. If in modern warfare the bombarding of the enemy with heavy artillery is supposed to have an unnerving result on the will and crushing the spirit, so the artillery of the elements of Toro, so admirably described by Sir Harry Johnston, undoubtedly has a corresponding influence on its inhabitants.

They have, on the other hand, strong imitative instincts, which render them apt pupils. Their features are decidedly superior to the ordinary African. The negro type of feature is a rarity, and instead one finds well-formed noses and thin lips, while the hands and feet are delicately formed except when deformed by disease, which is very prevalent in the form of syphilitic and other skin-diseases, resultant on the low moral tone of the tribe. They have discovered the properties of the boiling sulphur springs for medicinal purposes, and constructed small canals to carry off the water in order that it might sufficiently cool to enable them to use it for bathing. At a time of small-pox scare in Toro, I found that the people had a method of vaccination, which they explained was peculiar to their tribe, and known only to them. The Batoro, like their neighbours the Banyoro and Banyankole, practised blood-brotherhood.

VIEW OF THE MUBUKU GLACIER.

The natural inhabitants of Toro were the Bakonjo, who were driven into the mountains by their invaders. They have gradually become physically suited to their new mode of life. One is struck by the muscular superiority of this race. The men are the mountain huntsmen, and they go off on long expeditions in search of the hyrax or cony. These small creatures must be almost blind and devoid of instinct. They burrow in the rocks and live together in large communities; their captors will be at the entrance to the hole, and as one after another pops out its head, it is struck down and carried off, but, apparently possessing no means of communication between themselves, no warning is given to the others, so they continue coming out in single file, until sometimes the whole family is annihilated by these Bakonjo. The people adopt no clothing, except in some cases a few skins of the hyrax sewn together, or collobus monkey-skins are worn across the shoulder. Yet they seem quite inured to the cold that sweeps down from the snows at night. They will sleep in the open with no covering or shelter, the scanty vegetation affording no material for the erection of grass booths. Carrying wisps of lighted grass inside a sheath of bark, as night falls, they will kindle a fire and squat round in a circle with arms interlaced, and thus sleep. Unlike the Batoro, they do not build their devil temples in their courtyards, but in the forests, or wherever their most abundant spoil promises to be. I have noticed that among the people who are dependent on a particular craft for a livelihood, their religion extends to it, and not beyond. The fisherfolk round Lake Albert, for instance, will do nothing to offend the spirit, for fear of misfortune in their fishing, and practically the same idea sums up the whole belief of the Bakonjo. They live on a species of arum plant, snakes, and rats when less fortunate in their hunting. On one occasion a Mukonjo came to my house and offered to clear off the rats that had become more numerous than pleasant, and in a very short time he had replenished his larder considerably.

In Ankole two distinct tribes exist—the Bahima, or herdsmen, who are the invaders of the country, and the Bairu, the natural inhabitants and peasant class, who were given this name, meaning slave, by the Bahima. These folk are exceedingly suspicious of the Batoro, and resent any friendly overtures from them, such as have been made recently between the Batoro and the Banyoro. Their women have been kept in absolute seclusion, and are bound to cover their faces if they venture outside the boundaries of their hut, as is the custom in Mohammedan lands. This is peculiar to the Bahima, and points to the fact that the people must have migrated from northern districts. Their pronounced Nilotic features also bear this out. Doubtless they travelled down from the Nile in time of famine, and, coming across this excellent grazing-land, settled down with their cattle.

On the western side of Ruwenzori are a number of tribes varying considerably in number. One of the largest is the Balega tribe, that dwells on the western shores of Lake Albert, and extends back to Belgian territory. Their sole adornment consists of beads and wire twisted round their ankles and wrists. The chiefs will sometimes wear a cowhide. They recognize no ruling power, and have no king or leader. Each man is practically king of his own household, and, being an exceedingly prolific race and polygamy the practice, he often has a family of eighty to one hundred to control. The custom is for the whole family to live together in one house, so these reach quite big dimensions, and are constantly being added to in order to hold the ever-increasing inmates. They worship evil spirits, but the women are debarred from holding any belief, or taking a share in the religious exercises.

To the south of the Balega is the Babira tribe, who practise the same customs as the Balega. The women pierce the upper lip, and insert discs of wood varying in size from a mere thorn to a piece resembling a five-shilling coin, according to the rank of the woman.

The Bahuku, who live in the forests that stretch along the Semliki plain, are a strong and sturdy tribe. They allow their hair to grow to the shoulder, and twist it into streaks or tassels by means of goat's fat. The marriage custom is for the women to be given in exchange or another, or goats, when this is not possible. They still indulge in cannibalism among themselves. The smallest offence is the call to arms, and the scene of bloodshed is quickly cleared of its fallen warriors. They seldom honour their dead with burial, which the upper class will always allow to their goats and sheep, but the corpses are sold for one or more goats to another family.

MR. AND MRS. FISHER ON THE MUBUKU GLACIER.

The Bambuba live on the fringe of the great Congo forest. They vary in height from 4 to 5 feet. Their cultivation is exceedingly crude the trees are felled, and Indian corn, beans, and sweet potatoes are sown round the roots. They will not eat human flesh, except that killed in warfare. Polygamy exists among them, but each wife has her own house and servants. They build their devil temples among the long grass; only the old women are allowed to visit them with their offerings besides the men, who blow a horn to acquaint their wives with the time of their offering. They bury their dead in a sitting posture, with the hands folded across the chest; for six days the head is left unburied, so that the friends might gather round and mourn over the dead. After that period the burial is completed, and the grave kept well swept until arrangements are made for the household to move elsewhere.

The Batwa or pigmy tribe are their neighbours, and are the parasites of the tribes living round. From all the information I could gather during my visit of six weeks in Mboga district of the forests and from personal intercourse with them, I should say they are not a numerous tribe; they have suffered terribly from famine and small-pox in recent years. They do not cultivate, but live on hunting spoils and plunder. An elephant is the biggest bag and the tusks are exchanged with the Baamba for bananas, who use them for trading, or with the Bahuku, who convert the small ones into war-horns. The difficulty of procuring a good specimen of the okapi is no doubt owing to the creature's well-nigh extinction at the hands of these spirited little hunters. The constant call for self-defence against their stronger and sometimes plundered neighbours has made them a fearful and vindictive little folk. The semi-obscurity of the forest doubtless has resulted in their stunted growth. Their bodies are covered with an almost imperceptible down, which grows on the arms in the same direction as on the monkeys—that is, it meets towards the elbows. As they always sit with arms clasped round the neck, the constant rains falling off the trees might account for this. As regards mental calibre, I should say they are much in advance of the tribes living outside the forest. It may be, that, being continually on their guard against the wild animals that infest the forest, their minds have become more alert and active. Certain it is that they show a quickness for learning, and I have noticed that, while seeking to instruct a mixed class representing five different tribes, the pigmy will grasp an idea more readily and correctly than his competitors. If we are to look to him physically for Darwin's missing link, we cannot do so psychologically.

In conclusion, I would say that what forced itself on me while living among these people of the western province is that deterioration is naturally stamped everywhere, or, if we must admit evolution, it must be the evolution of evil. Whether we speak of the general features of the country, or the spiritual, mental, and physical characteristics of the people in their natural condition, demoralization is the outstanding feature. But there are tremendous political, commercial, scientific, and psychical possibilities if we, as Britishers of the

Protectorate, are willing to direct our interests in not only this western province, but Uganda as a whole.

The Uganda railway has cost the British Government £7,000,000 to construct. What return have we got to justify this great outlay? We have, in the words of Lord Rosebery, "pegged out a claim for futurity." We are effectually able to control the headwaters of the Nile, which is the life of Egypt. The slave trade has received its death-blow, and the warships which looked after the slavers on the East Coast can now be used elsewhere. The cruelties of human porterage have disappeared, and inter-tribal wars have ceased. The missionaries have been able to carry on their good work in peace; thousands of the natives have become Christians, and under the present enlightened policy of our able and kindly High Commissioner, Colonel Hayes Sadler, C.B., education is encouraged and industries fostered. In short, the Uganda Protectorate is like a spring day, everything bursting into life.

The implicit trust and confidence which the inhabitants have in Colonel Hayes Sadler and his able Deputy-Commissioner, Mr. George Wilson, C.B., have increased their loyalty to our nation, and have inclined them to settle down to the development of their country, so that we may look, in the near future, for a very large increase in the export of coffee and cotton from the Protectorate.

The Uganda Protectorate is, in my opinion, the greatest asset of our nation in all East Africa. The inhabitants are to a great extent Christian, exceedingly intelligent, progressive, and most loyal—facts which will always secure the peace, not only of the Protectorate, but also of the surrounding territory.

Before the reading of the paper, the PRESIDENT said: I have pleasure in introducing to the meeting one of those pioneer missionaries, Mr. Fisher, who for the last fifty years have done so much for the exploration of Africa. He will give you an account of his experience in Western Uganda, which I feel quite sure will be extremely interesting and valuable. I now call upon Mr. Fisher to address you.

After the reading of the paper—

Mr. J. F. CUNNINGHAM: I fear I have very little to say, except to give expression to what all of us feel—our gratification at the interesting address that we have heard. Most of you, perhaps, think that it is quite easy to write original matter regarding Uganda and the territories adjoining. But I think you would alter that opinion if you tried it. No Society knows better than you how many able men have visited that district, and how thoroughly they have described it. I might mention General Lugard, Sir Harry Johnston, Mr. Moore, Major Powell-Cotton, and Mr. Grogan—all of them very careful observers and admirable descriptive writers. Where these men have travelled and described, it is not an easy matter to pick up new information, and yet Mr. Fisher has managed to get a great amount of original information together. I think I know why. Mr. Fisher is known locally as a very expert linguist; he knows several native languages, and he has lived in close personal relations with the tribes he has described. It is to that, I think, we owe the essence of the interesting discourse to which we have listened. There are certain subjects—botany, for instance—that the ordinary traveller may describe. Botany has no secrets; its history is written on the leaves and stems of every plant. The same may be said of geology to a certain extent, because geology has an outcrop to guide the observer and the traveller; but to describe the intimate personal habits of these tribes cannot be done without an intimate knowledge of the language of these people. That Mr. Fisher has. What strikes me as most remarkable is that he should have described all these people without a trace of exaggeration in any one particular that I can allude to. I have collected some information myself regarding these people, and may at once say that I owe it, not to myself personally, but to the information I have been able to glean from the missionaries. When a missionary settles down in any one particular district, his first aim and object is to master the language of that district. Having mastered it, his station becomes a centre of religious instruction; not only that, but it becomes a centre of secular instruction also, and, as you have seen from the photographs shown on the screen, not only are these mission stations centres of secular and religious instruction, but a considerable amount of work is done in the matter of handicraft. You have seen how the natives have been taught to make bricks, and how they have been taught to build houses of a serviceable kind. All that is the work of the missionaries. Now, Mr. Fisher has covered almost the whole of this map that I have in my hand, and I am afraid of keeping you too long, but in regard to the Bahima people—and just to start a discussion for any one who wishes to follow—in regard to the origin of these tribes and the other tribes along there in Ankole and Toro, I might mention that I have found an additional matter on which to base, in a slight way, a belief in the fact that these people are of a northern origin. Mr. Fisher has alluded to a certain method of hairdressing amongst the Bankole, and other matters. Now, in addition to that, the women of Ankole are a very closely veiled people; they never expose their features, and they are always confined to their private apartments. As you know, that is not a Central African custom; it has a tendency to lead one to Egypt to account for that, and I believe the white man—the Kintu that Mr. Fisher referred to—would be considered white if he were an Egyptian coming amongst these people, who are perfectly black. On the other hand, I have made a great many measurements of the heads of the Ankole people, and I find that they are dolichocephalic, and this leads one to the conclusion that in that one respect they resemble the Somalis and the Egyptians. Now, the Ankole people have a religious belief in a future state. Mr. Fisher has not touched on that; but the King of Ankole himself and his ministers told me that the future state for the elect is called Mitoma. It is not placed in Ankole, but it is far away beyond German territory, and the entrance to that place is a sort of mystic tunnel in the Ankole forest. The king himself gave me an imitation of the noises made by the spirits in passing into that tunnel. I am sorry I cannot attempt an imitation. Well, this state is a state of perfect rest—there are no clothes required there; there is no herding of cattle, no work, no cultivation of bananas, no food required, no drink, and, mind you, it is not intended for the righteous alone. The wicked go there as well as the good. Every one is admitted there except the peasantry. The Bairu, or working class, are not admitted to the Mitoma of the Ankole people. Not only are the Ankole people interesting in this way, but they have given to the Bakonjo people a god. This god, I found out from the people themselves, was originally an Ankole man. He was driven out of Ankole, and he was accepted by the Bakonjo. A man, you know, is never a prophet in his own country. His great qualification for being a deity was not a small one in this twentieth century—he was bullet-proof; he was also spear-proof, and these two qualifications alone were quite sufficient to recommend him to a naked people who were not bullet-proof. I have asked one of the officials of the Geographical Society to prepare a lantern slide showing three of these people worshipping at what they call the temple of their ancestors.

Now look at this picture of the hukiko sitting in session. That is the Uganda parliament. You see, as in your parliament, they are ranged in two columns, but they are not in opposition. That is the king in the chair, in the dark over there, and these are the leading chiefs. If it would not be too wearisome, I will tell you how the house is composed. There are eighty-nine members. I was almost tempted to call it the mother of parliaments, because, I believe, it was in existence before our own, but its present constitution was given to it by Sir Harry Johnston. Uganda is divided into twenty provinces; each province has a separate member who draws £200 a year. There are three Regents and twenty county members. Each county also selects three of its notables. We have not got to any ballot-box election at the present time, but public opinion points out who are the distinguished men of the county, and these people take their seats in this parliament. In addition to them, there are important persons who may be connected with the royal house of Uganda, or who have distinguished themselves either in the past or in fighting for or against the mutineers, or in some other way, and these are entitled to a seat in this House—making eighty-nine members. Now, there is no dissolution in this house, because, I suppose, there are no parties. Probably that will come later on. But, at all events, a member of this house, if he becomes obnoxious to the king, cannot be removed on account of expressing his opinions freely. The Commissioner on behalf of the Government has a veto in removing any man, so that prevents any unjust treatment so far as a free expression of opinion is concerned.

Rev. Canon SMITH: I will only speak just a few moments, and the interest of what I have to say lies in the direction of pointing out what extraordinary progress has been made during the last fourteen years. Fourteen years ago I was journeying to Uganda through German territory, and at that time the country scarcely belonged to us at all. It is since those days that we have acquired, without dispute, the territory of Uganda, and I can recollect the time when General Macdonald came into Uganda for the purpose of surveying for the railway. I can also remember when there was only one church in the whole of the Uganda Protectorate. I can also remember when the first octagonal house was being built, and at that time it was necessary to hold sticks and threats over those who carried on the work. When I mention this, you will understand what extraordinary progress has been made during the last fourteen years. Some intensely interesting questions have been raised by the remarks of Mr. Fisher to-night, and I had hoped there might have been time to speak about them. I will only refer to one of these questions to which I allude, namely, the distribution of the black man over the whole of Africa. From which point did that distribution commence? is a question suggested to my mind to-night. My own belief is that it began from the north-eastern part of Africa, and the black people have been gradually driven across to the West Coast. I make this remark partly because it is my duty now to work on the West Coast, and it is only a week since I landed from Sierra Leone, and during my work there I have been intensely interested in noticing questions and subjects of similarity and dissimilarity from those things I observed on the East Coast. And just speaking for a moment, I would suggest one or two special subjects which this Society through its members might make a study of. I believe we have paid far too little attention to the mourning and burial customs of these people. Then, again, I think we have shown far too little notice to the signs of primitive art which may be discovered throughout the whole of Africa. Some are extremely primitive, but they are all suggestive; and I think if we pursue the question, we shall yet learn a great deal about the past history of these people. I would only say one more thing, and that is, there was a photograph shown which referred to the extraordinary character of the waves on Victoria Nyanza. Twice I have crossed the lake, and, curiously enough, I was one of those who occupied a boat during that particular storm the picture of which was shown to you to-night. That picture was taken by Bishop Tucker, and I was with him when it was taken. Now, I have travelled over the ocean both on the east and west coasts of Africa, and I can assure you I have never seen any condition of the ocean waves which seemed to correspond in magnitude with the waves on the Victoria Nyanza. I think that is a subject of interest, and it leads us to inquire how these gigantic forces are brought into existence, and what they all mean, in the course of our future studies.

The PRESIDENT: I think we must now thank Mr. Fisher for his most interesting paper. The pioneer missionaries of Africa, from the days of my old friend Dr. Livingstone until now, have done a very large share—more, I think, than their proper share—a very large share indeed of the exploration of this great continent. We have recognized their work on more than one occasion by giving our Gold Medals to pioneer missionaries and our other Awards, but I do not think any of those missionaries have excelled Mr. Fisher in the careful studies he has made of the tribes with which he has come in contact. I am sure none have given us a more interesting evening. I propose, therefore, to you that you should pass a very cordial vote of thanks to Mr. Fisher for his paper, and also, as Mr. Cunningham has suggested to us, that we should combine with that vote the name of Mrs. Fisher. I think we are also bound to thank Mr. Cunningham and Canon Smith for their most interesting addresses.

Had time permitted, Captain C. RODNEY MUNDY would have made the following remarks: There are one or two points in the interesting lecture we have heard to-night to which I should like to briefly refer. In the first place, with regard to the origin of the Ba-Hima, many things seem to point to their having come from the north-east, and of a Semitic rather than a Hamitic stock; and I think there can be very little doubt that they were originally a light-skinned race, although there are now plenty of dark Ba-Hima to be found—this, I think, being due to a mixture of negro blood. They are, of course, a purely pastoral race of cattle-breeders, and the true Mhima will not touch anything but beef, milk, cold water, thoroughly despising the banana and all its products. Neither will he touch mutton, even when almost starving, nor grain. Now, it is an interesting fact that there is in Central Africa another race of originally light-skinned, thin-lipped, Semitic people, who are in their original state pure cattle-breeders, and are nomadic equally with the Ba-Hima. I refer to the Fulani or Fulbe, who, although they are now the ruling race in a large part of the hinterland of West Africa, were originally merely nomadic herdsmen. When I was in Northern Nigeria, and conducting a few inquiries into the habits, etc., of the still nomad portion of the Fulani, I was very much interested to discover several words and expressions, especially connected with their cattle, which are identically the same in Fulani and Lu-Hima. The origin of the Fulani is also lost in obscurity. Is it not possible that both these races are descended from some common stock, and have migrated in divergent directions from somewhere to the north or north-west of Darfur? Secondly, with regard to what Mr. Fisher has told us with regard to lakes

Albert Edward and Edward having formerly been much nearer together than at present—there is plenty of evidence to show that Lake Albert Edward was once much larger than it is at present. I was particularly struck with the unmistakable proofs I found that the southern shore has long been receding northward, and is still doing so at the present day, at a fairly rapid rate. On the other hand, there is some reason for thinking that before the Mfumbiro chain of volcanoes was thrown up the drainage of Lake Albert Edward was south to Lake Tanganyika, and not north to Lake Albert; and these volcanoes cannot be of very ancient date.

GEOGRAPHICAL DISTRIBUTION OF VEGETATION OF THE BASINS OF THE RIVERS EDEN, TEES, WEAR, AND TYNE.*

By FRANCIS J. LEWIS, F.L.S., Assistant Lecturer in Botany,
University of Liverpool.

PART II.

The area now under consideration lies immediately to the north of Part I., the eastern and western boundaries of the two maps being continuous. The field work for this paper was begun at the same time as Part I., and was finished last autumn. The boundaries of the various plant associations have been laid down upon the 6-inch Ordnance maps in the field, and subsequently reduced on to the 1-inch maps for publication. The maps now published are contoured every 100 feet up to 1000 feet, then every 250 feet up to 2000 feet, and above this height the contours are given every 500 feet. The lower limit of the Alpine moorland follows the 2000-feet contour-line very closely, but elsewhere the plant boundaries have no direct connection with the contour-lines, frequently running at right angles to them. The boundaries have been fixed by the landmarks shown upon the large-scale maps, such as piles of stones, sheepfolds, scars, and streams] The height of most of these landmarks are given on the 6-inch maps, and can easily be identified with the aid of a good aneroid registering to 50 feet, the aneroid being frequently checked during the day by means of the summits.

TOPOGRAPHY.

The area now under consideration covers the rising ground of the Tees, South Tyne, and Wear, and includes Sheet 25 and part of Sheet 24 of the 1-inch Geological Survey. The water-partings consist of two main ridges, the Cross Fell chain on the west forming the water-parting of the Tees and Tyne and part of the drainage system of the Eden, and the Weardale Fells on the east. The former ridge trends north-west and south-east, and rises abruptly from the Eden valley to a height of 2930 feet on Cross Fell, and does not fall below 2500 feet for a distance of 5 miles in a south-easterly direction. From Cross Fell the level of the ground falls rapidly to the east into the Tees basin, and to the north into the Tyne basin. A range of hills runs north-east from Cross Fell, and forms the parting between the Tees and South Tyne.

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* Continued from vol. xxiii. p. 331. Map, p. 376.

The Weardale Fells consist of a central ridge running almost north and south, which bends round to the east at each end, and is continued on each side of Weardale to the eastern limit of the map—on the south at a general level of 2000 feet, and on the north at about 1700 feet. A considerable area of country thus lies above 2000 feet, the actual figures being 41 square miles.

Nearly the whole of the present area consists of unenclosed moorland, except the narrow cultivated dales of the Wear and South Tyne, Harwood, and a small strip of the Eden valley in the south-west of the map.

Rock exposures, such as crags and scars, although not frequent, are found chiefly at lower levels, although scars frequently occur at 2000 feet on the western escarpment, sometimes being continued for considerable distances, as in the case of Melmerby High Scar. Above 2000 feet the ground consists of bleak, gently sloping moorland, often arranged in a series of flat terraces.

In Weardale the tributary burns from the watershed flow down short, wide, upland dales or "hopes," which differ greatly from the narrow, steeper, and longer ravines or gills of the Cross Fell chain. The former are generally grass clad, the latter usually covered with heather.

GEOLOGY.

The district consists entirely of Triassic, Permian, Silurian, and Carboniferous rocks. The Triassic and Permian are confined to the Eden valley on the south-west of the map. Much of this area is covered with a thick deposit of earthy gravel and till, and is under cultivation. The rock exposures chiefly occur in the neighbourhood of Melmerby and Ousby, and by the sides of streams, and these areas are generally well wooded, oak occurring in considerable quantity, mixed with other trees.

From Melmerby south-eastwards, the Permian and Triassic region is bounded by an area of Silurian rocks, which form a series of rounded hills and pikes standing between the Eden valley and the western escarpment of the Pennines. Most of these hills are pasture clad, with a considerable mixture of *Vaccinium Myrtillus*.

The whole of the area to the east of the main Pennine fault is formed of Carboniferous rocks, the lower series consisting of limestones and sandstones, and an upper series consisting mainly of sandstones, grits, and shales, traversed by a few thin beds of limestone.

These districts show clearly the difference, both in configuration and vegetation, of hill masses formed of the two types of rocks which have been named by Thurmann (1849) dysgeogenous and eugeogenous. The hills formed of the former kind of rock yield only a small amount of detritus, whilst a much larger amount is yielded by the latter. The thick shales and grits of the Weardale watershed, traversed by only a few thin beds of limestone, are typically eugeogenous, upon which flourishes a wet type of heather vegetation. The hills of the Cross Fell chain, on the other hand, are much more dysgeogenous in character, for, although traversed by beds of grits and shales, the limestone beds are much more massive, and occupy a greater area than on the Weardale Fells. These hills support a vegetation of a drier type than the purely eugeogenous hill. The differences in the vegetation covering these two types of hills will be considered more in detail when the vegetation of the moorlands is under review. The Whin Sill is well exposed along the western escarpment, forming a prominent feature in nearly all the gills which furrow the face of the western slopes. It is also exposed at several stations on the eastern side of the Pennines, the largest exposures being situated by the side of the Tees from Dead Crook to High Force.

Most of the upper moorland regions bear a thick covering of peat, which in many places rests upon glacial clay, and which has been seen to occur as high as 2450 feet on the eastern slopes of the main Pennine ridge.

A full description of the glacial phenomenon of this region is given by Mr. J. G. Goodchild in the *Quart. Jour. Geol. Soc.* (1875), and by Mr. Dwerryhouse in the same journal for 1902.

The geology of that part of the area lying within the counties of Northumberland and Durham is described in 'The New Flora of Northumberland and Durham,' by Mr. J. G. Baker (1881), and this work also contains summaries of the salient features of the flora in different areas in Northumberland and Durham.

AREA OF CULTIVATION.

The area of cultivation only covers 63 square miles, and the greater portion of this is under permanent pasture. The whole of the Eden valley, and the bottom of the dales of the Tyne, Wear, and Allen included in the boundaries of the map, are under cultivation, with occasional patches far up the hillsides. The only region in which cereals are grown at the present time lies in the Eden valley and in Weardale east of St. John's Chapel.

No wheat is grown within the limits of the present map, the chief crop being oats. The upper limit of this region of cultivation rises at the foot of the western escarpment of the Pennines to a height of 800 to 900 feet in some places, though its general level is about 600 feet. Above this a fringe of permanent pasture is met with, stretching to the limits of cultivation. In most of the dales cultivation extends to a much greater height than in Part I. In Tynedale the general level of the upper boundary of cultivation lies at about 1750 feet on the east side, and 1000 feet on the west, with two outlying patches (Calvertfold and Shellwell) near Tynehead at 1850 feet. The same general level is reached in Nentdale. In Harwood cultivated land is met with as high as 1950 feet at the hill farms of Grass Hill House and Manor Gill House, and only slightly less elevations at which cultivation is carried on are met with in Weardale. The pasture at these altitudes, however, is often wet in character, and with the same general flora as the surrounding grass heaths.

Although all the records of rainfall lie within the region of cultivation, they are of interest as showing the great increase of rainfall in the neighbourhood of the main Pennine ridge.

Zone of vegetation.		No. of observations.	Altitude above sea-level.	M.A. rainfall.
			Feet.	Inches.
Oats	Penrith	12	575	31·78
Near limit of oats cultivation	Melmerby	6	583	36·63
Permanent pasture ...	Alston	5	1145	49·03
" " ...	Allenheads	4	1353	42·39
" " ...	Wearhead	3	1104	48·70
Near limit of oats cultivation	Eastgate	4	798	37·75
Wheat	Bishop Auckland	10	408	25·54

WOODLAND.

The natural woods are entirely deciduous, and occur as straggling copses by the sides of streams, in gills chiefly on the borders of the Eden valley in the western region of the map. Amongst the mixed deciduous woods, hazel and ash are less frequent, and rowan and birch generally more plentiful, than in Part I.

The chief trees occurring in the stream-side copses are—

Corylus Avellana, L.
Betula verrucosa, Ehrh.
Pyrus Aucuparia, Ehrh.
Alnus glutinosa, Medic
Fraxinus excelsior, L.
Quercus Robur, L.

None of the other deciduous woods rise higher than 900 feet on the western side of the main Pennine ridge, and 1500 feet on the eastern side, and these altitudes are only attained in the most sheltered places. Isolated shrubby trees—chiefly willow, birch, rowan, and ash—occur occasionally as high as 1700 feet by the sides of scars in deep ravines, but there are very few places where even stunted trees are found so high.

PINE WOODS.

Several fairly large plantations of Scots pine occur in the Eden valley, in Tynedale, and in Weardale, the highest elevation attained being 1600 feet at Greencastle, and about 1750 feet at Allenheads. At

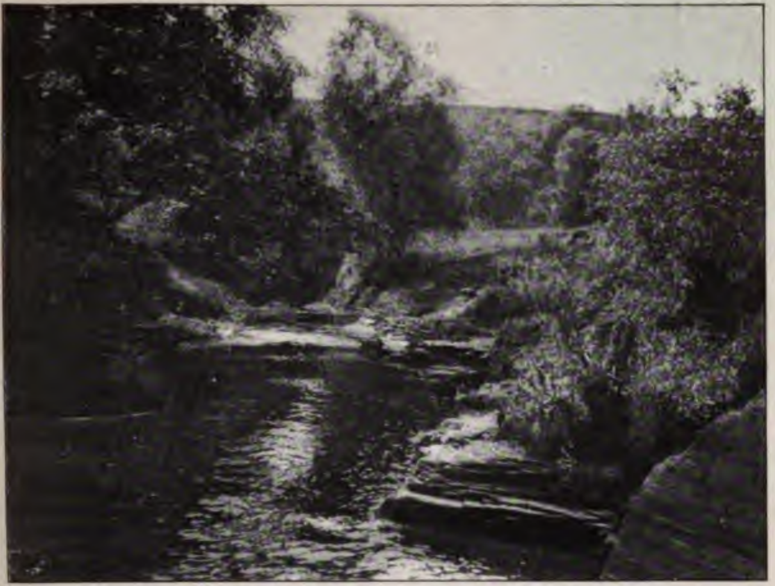

FIG. 1. Birches in Ashgill.

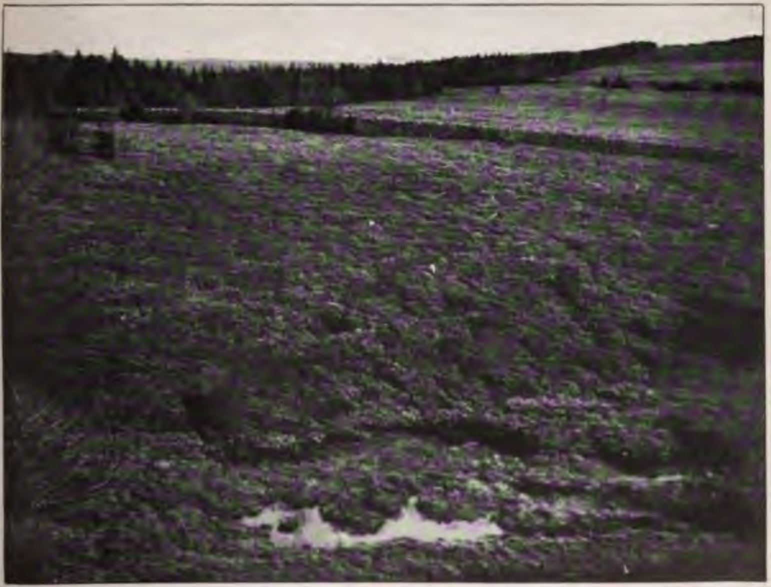

FIG. 2. Spruce plantation on Ashgill Head at 1,750 feet.

these altitudes the trees are straight and well grown, but above this they tend to become dwarfed and stunted, and although occurring frequently in the large spruce plantation at Ashgill up to 1700 feet, they thin out rapidly after this height is reached.

Examination of the peat has been made to collect evidence whether the Scots pine is indigenous in this area. Some stations have been discovered on Cross Fell at 2400 feet, and one of these is shown in Fig. 4, but I was quite unable to find the extensive pine remains referred to by Nathaniel Winch (1825). He says—

"On the elevated moors between Blanchland, at the head of the Derwent, and Wolsingham, on the river Wear, and even on the mountains of Cross Fell, at an elevation of nearly 3000 feet, the roots and trunks of very large pines (*Pinus Sylvestris*) are seen protruding from the black peat moss, being exposed to view by the water of these bogs having drained off and left the peat bare; but this tree is no longer indigenous with us."

Undoubtedly the peat upon the higher moors is being denuded very rapidly, but it seems scarcely possible that nearly the whole of these extensive remains should have been denuded away since the time this was written, but careful search during the field-work for this map has only revealed the remains I have mentioned, and the wood here is of quite small size; but it is probable that the more extended and numerous sections through the peat which I am making in sub-alpine districts will yield further remains. Most of the plants characteristic of primitive pine woods occur in this district—though in most cases very sparingly—such as *Linnæa borealis*, *Pyrola minor*, *P. media*, *P. rotundifolia*, *P. secunda*, *Trientalis europæa*, *Listera cordata*. Their rarity, or even their absence from modern pine plantations in the district, proves nothing in the face of pine-wood remains in the peat, particularly when we remember that the primitive pine had probably disappeared ages before any artificial planting took place.

SPRUCE WOODS.

The greater number of coniferous plantations consist of spruce, much of it having been planted in the days when mining operations were carried on in the district. A small amount of planting is being done for the supply of the few mines still working; but in most cases the coniferous plantations east of the main ridge of the Pennines are in a state of decay.

The largest wood occurring in the present area is at Ashgill, and this rises from the side of the North Tyne at 1200 feet, and runs up the hillside to 2015 feet. The lower portion of the wood consists chiefly of deciduous trees, ash being the most prominent. This portion of the wood is now very thin, no replanting having been carried on for many years, and each winter takes its heavy toll of blown-down trees. To the east of the Alston-to-Middleton road, which runs through this wood, nearly all the trees are spruce. A slight mixture of rowan, ash, beech, and pine occur up to 1700 feet, but after this level has been passed we meet with only spruce, Douglas fir, and a few larches. Beech occurs as a fringe outside the western margin of the wood at 1600 feet, and appears to withstand the severe winds remarkably well; but there is no evidence that it has ever been indigenous in the district.

The chief interest centres in the narrow strip of plantation which runs up from the main body of the wood at 1750 feet to 2015 feet. This consists entirely of coniferous trees — spruce, Douglas fir, and larch—all rather small, and many assuming almost a creeping habit. The larches in particular, at about 1900 feet, show well-marked elfin growth, the stem being almost prostrate, not more than 3 or 4 feet in length, with long, strongly curved drooping branches. Many of the spruce stems lie closely pressed to the ground, having been blown into a horizontal position by wind, though some of the roots have still retained their hold upon the soil. The whole of this part of the plantation would probably have been swept away before but for the protection afforded by a 6-foot dry stone wall, which encloses the plantation from the surrounding fell land. Some instructive evidence of wind-action is also to be seen at the summit. Here the spruce forms a dense shrubby growth about 2 or 3 feet in height, almost like the spruce mats mentioned by Kihlmann (1890) as occurring near the northern tree-limit in Russian Lapland. These mats are dotted over the surface of the ground at varying distances from the shelter wall, and they appear to be due to the natural spread of the planted spruce. This plantation affords the only example of woodland above about 1700 feet, and the rapid stunting in the growth which takes place at above 1800 feet, and the shrubby habit assumed by all trees at 2000 feet which are not directly sheltered by artificial means, afford some confirmation of the adoption of the 2000-feet contour-line as the lower limit of the Alpine region. It may be pointed out that the Ordnance station at 2015 feet is by no means an exposed summit ridge, but the edge of an almost level plateau which extends for about 1½ mile to the south-east, rising there to the summit of Burnhope Seat at 2452 feet. In the case just described, Douglas fir appears to withstand the desiccation produced by the wind at a high altitude better than any of the other conifers, spruce coming next. No example of Scots pine was observed above 1750 feet.

Birch Woods.—No regular birch woods are found in the present area, small birch copses only being present in a few cases by the sides of streams. The same extensive birch wood remains that were met with in the Part I. area have been noticed here and traced to higher altitudes. No widespread remains have been found on the western escarpment of the Cross Fell chain, but on the north-east slopes, *i.e.* in the basins of the Tees, Tyne, and Wear, the traces of former birch

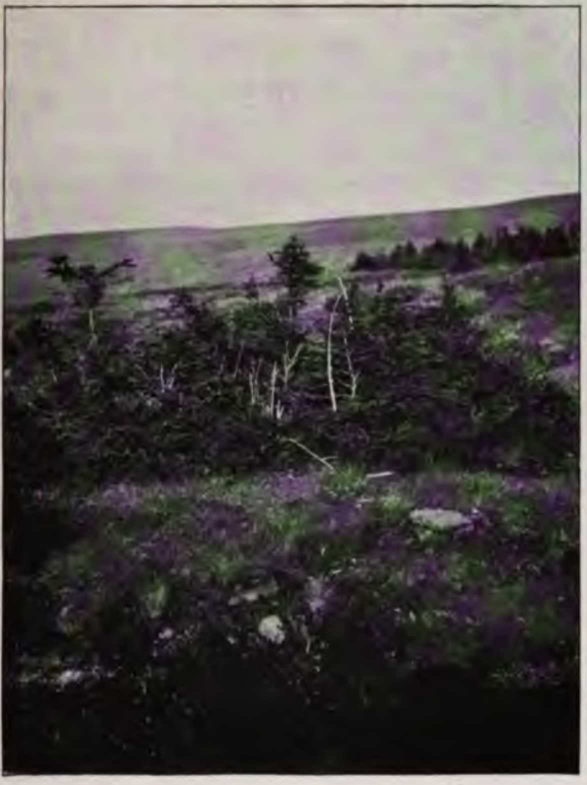

FIG. 3. Shrubby growth of spruce at 2,015 feet on Windy Brow.

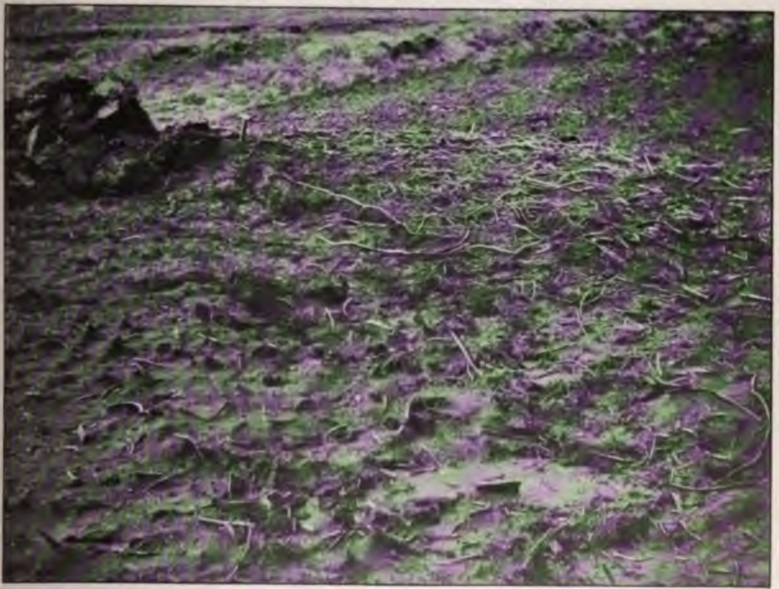

FIG. 4. Pine remains exposed by the denudation of the peat, S.E. of Cross Fell at 2,500 feet.

woods meet the eye everywhere. These remains can be traced over all the Vaccinium and Heather moors, and Eriophorum and Heather moors (VH and EH on the map) in Upper Teesdale, are continued over Tynehead Fell, though not so abundant here; whilst the Eriophorum, Vaccinium, and Heather moors (EVH) and the Eriophorum and Heather moors of the Weardale Fells appear to have supported dense birch woods at some post-glacial period, the eastern slopes appearing to have been more thickly covered than the west. Briefly stated, nearly all the Heather areas, both in Parts I. and II., appear to have supported woodland, the wood in most cases having been birch. This ancient forest appears to have run up nearly to the summits of the highest fells, plentiful remains having been found at 2600 feet on Cross Fell, 2500 feet on Knock Fell, and 2350 feet on the Weardale Fells.

The present birch thickets are confined to sheltered places, such as small ravines and hollows, always near the heather moorland, and they appear to be the representatives of the ancient birch forest. Passing south from the present district, remains of birch, alder, and oak, have been observed by Messrs. Clough and Barrow (Memoirs Geological Survey, 1891), in the peat covering the upper part of Wensley Dale, Swaledale, and Arkendale, extending up to 2050 feet, and in fact such tree-remains—chiefly birch at the higher levels—have been observed all along the Pennines from Derbyshire to the Cheviots. Such buried forests appear to be almost a constant feature of the peat in Great Britain and Northern Europe generally, and the same feature has been observed in the peat beds of some parts of North America. The widespread occurrence of tree-remains so far above the general level of woodland at the present day seems strongly suggestive of a change of climate, and this is borne out by an examination of the peat at different depths.

Microscopic examinations of the peat show that *Sphagnum* was predominant at intervals during the deposition of the peat beds, certain layers being wholly formed of the leaves, stems, and capsules containing the spores of this moss. Again, these beds of *Sphagnum* merge into peat containing numerous remains of shrubby plants, such as *Empetrum*, *Calluna*, *Vaccinium*, which again in some cases give place to birch remains. The existence of these buried *Sphagnum* beds are noteworthy in connection with the present scarcity of *Sphagnum* in the area. The sections which have already been made during the progress of this survey also show a considerable change in the character of the plant-remains towards the base of the peat. Near the glacial clay birch is either absent or rare, and its place is taken by shrubby Alpine willows, some six species of which have already been recognized, together with the remains of Alpine plants which are either uncommon or altogether absent from the district at the present day—a vegetation strongly suggestive of tundra conditions.

Graebner (1901) has found that extensive heather areas in North Germany have been formed from forest, and in view of the extensive remains of woodland on all the heather moors along the Pennines and at all altitudes, the same origin of the heather moors may be claimed here.

Much of the heather moorland of Parts I. and II. below 1500 feet appear to be well adapted for reafforestation with mixed coniferous wood, more particularly the heather moors on thin peat to the east of the Pennine ridge. When the peat becomes deeper and wetter, however, a moor-pan is nearly always present, and planting on an extensive scale would probably entail considerable difficulties. Most of the hopes in Weardale, the gills in Teesdale below High Force, and in North Tynedale would with scientific management support extensive and profitable mixed coniferous woods. It is interesting to note, in connection with the woodland, that only 3¾ per cent. of the total area of Parts I. and II. are now covered with woodland. The actual figures are—

Total area of Parts I. and II.	560 square miles.
Area covered with woodland at the present time	11 „

The area in which traces of former forest have been noted during the field work is about 140 square miles. This is excluding the area of cultivation, most of which we may assume was under primitive forest.

SUB-ALPINE MOORLAND. NATURAL PASTURE.

The best development of pasture is to be seen in the neighbourhood of the limestone scars which form a conspicuous feature of the south-west slopes of Cross Fell below 2000 feet, being well developed on thin calcareous soil often not more than a few inches in depth. Two small areas of pasture occur near Belbeaver Rigg, on small outcrops of limestone only a hundred yards from an extensive Eriophorum bog, and it is interesting to note the changes in vegetation between these two areas. The pasture area is surrounded by a border of well-developed Nardus grass heath only a few feet in width; outside this is a broader zone of grass heath with Eriophorum, the external edge of which rapidly shades into Eriophorum bog. The transition is well shown in the autumn even at a distance, the bright green of the pasture contrasting with the white Nardus zone, the brownish Eriophorum grass heath, and the surrounding sombre dark-hued Eriophorum bog. The pasture is developed on a thin limestone soil, the border of Nardus heath on glacial clay free from peat, the Eriophorum grass heath on thin peat, which rapidly deepens when the Eriophorum bog is reached. The flora of the pasture does not differ materially from the scar pasture of Part I.

The boundaries between the Pasture and grass heaths have not been defined on the maps, and they are both represented by the same colour with a view to avoid complication, but the position of the more

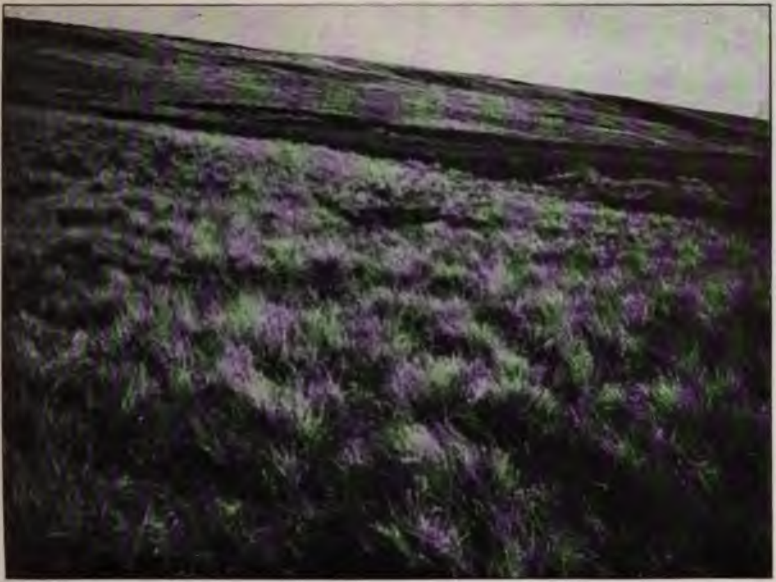

FIG. 5. Boundary of Calluna Moor, and Grass Heath with Eriophorum on Redbourne Edge.

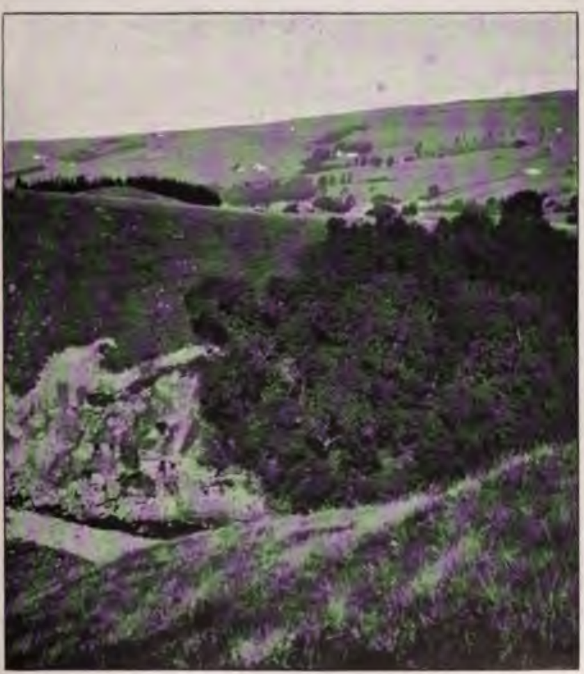

FIG. 6. Looking North across Tynedale from Cross Gill. Grass Heath slopes in background, Birch Wood in the gill.

important pasture outcrops have been indicated by lettering. The area so covered is much less than in Part I., the present district being a typical dry grass heath and wet heather country.

Grass Heath.—Grass moor attains a much greater development over the present area than on Sheet I., and extends as a broad fringe covering all the lower slopes of the Weardale Fells. A steady increase in its area can be noted as we pass eastwards from the highest region of the Pennine watershed. Two chief types can again be recognized—(*a*) Grass heath developed on steep dry slopes nearly free from peat; (*b*) Grass heath developed on deep wet peat-covered ground and in hollows.

(*a*) *Grass Heaths, developed on Steep Dry Ground.*—The dominant plant in such situations is invariably *Nardus stricta*, and many of the steep hill slopes are covered with an association composed almost entirely of this plant, mixed with a few plants characteristic of dry peat with a sprinkling of pasture plants. The following list of plants from the eastern slopes of North Tynedale at Windy Brow are characteristic of most of the drier grass heaths:—

[*]*Nardus stricta*, L.
Juncus squarrosus, L.
Potentilla tormentilla, Scop.
Galium saxatile, L.
Vaccinium Myrtillus, L.
Lotus corniculatus, L.
Trifolium repens, L.
T. medium, L.
Festuca ovina, L.
Deschampsia flexuosa, Trin.

Two chief intermediate types of this Nardus grass heath are formed. In one case the Nardus may occur with a considerable quantity of *Vaccinium Myrtillus*, in the other type Nardus occurs in company with Calluna. These two intermediate associations have been distinguished on the map as grass heath with Vaccinium (VGH) and grass heath with Calluna (HGH). Much of the western escarpment of the Pennines above the Eden valley is covered with the Nardus and Vaccinium type of grass heath, particularly below the Vaccinium Edge, which extends from Stoney Rigg to High Scald Fell on Sheet I. Where this type of grass moor is well developed, there is often a tendency for *Deschampsia flexuosa* to replace Nardus as the dominant plant, and this can be well seen near Cuns Fell on the Cross Fell chain, where the Nardus has been replaced to a great extent by *Deschampsia flexuosa*, *Juncus Squarrosus*, and abundant *Vaccinium Myrtillus*. As the quantity of Vaccinium increases, Nardus becomes replaced more and more by *Deschampsia flexuosa*.

The association of Nardus with Calluna (HGH) is well represented on the slopes of the fells to the east of Harwood, in Tynedale, and in some parts of Allendale. On all the lower slopes, particularly when heavily stocked with sheep, there is a general tendency for Nardus to replace Calluna as the dominant plant. The author has reliable evidence, from many different sources, that many of the areas which are now covered with a Nardus-Calluna association were, half a century ago, covered with Calluna moors. On most of the drier Calluna moors Nardus is always found, forming little patches of grass heath in the drier places. In some of the areas mentioned, the constant treading, manuring, and browsing by the sheep, to which the Calluna has been exposed, has had the effect of killing it, and its place has been taken by Nardus and other grasses typical of dry conditions.

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[*] The nomenclature of the London Catalogue, 9th edition, is followed throughout.

(*b*) *Grass Heath developed on Wet Peat-covered Ground.*—Much of the ground on the higher slopes forms a series of gently sloping terraces, and on these a distinctly wetter type of grass heath is developed, dominated by such grasses as *Molinia varia*, with a slight mixture of *Eriophorum vaginatum*.

This association is richer in species than the Nardus heath, the following being the principal plants:—

Molina varia, Schrank.
Agrostis vulgaris, With.
A. canina, L.
C. flava, L.
C. pallescens, L.
C. fulva, Good.
C. panicea, L.
Carex ovalis, Good.
C. curta, Good.
Scirpus cæspitosus, L.
Juncus conglomeratus, L.
Juncus lampocarpus, Ehrh.
Hydrocotyle vulgaris, L.
Sphagnum, spp.

When the ground becomes flatter, and particularly at higher altitudes near the Heather-Eriophorum area, this association becomes mixed with a greatly increased quantity of Eriophorum, distinguished on the map as grass heath with Eriophorum (EGH).

Deschampsia cæspitosa is frequently a prominent grass in this association, and in many cases it replaces Molinia as the dominant plant.

A list of plants from a grass heath with Eriophorum area on Tynehead Fell is as follows:—

Molinia varia, Schrank.
Deschampsia cæspitosa, L. } Dominant.
Eriophorum vaginatum, L.
Scirpus pauciflorus, Lightf.
Sphagnum, spp.
Juncus conglomeratus, L.
J. lampocarpus, Ehrh.
Carex flava, L.

The two best-represented varieties of grass heath in the present area is Nardus and grass heath with Eriophorum. The former is best developed along the lower and drier slopes of the fells in Tynedale and Weardale, and can be seen at its best on Windy Brow near Tynehead and at Redbourne Edge in Rookhope. The determining factors in the distribution of these two types of grass heath appear to be water and peat. Numerous sections have shown that the Nardus heath is always developed on thin peat or glacial clay situated on a steep well-drained slope, whilst, on the other hand, Eriophorum grass heath occurs on thicker (sometimes 1 or 2 feet) peat, with an iron-pan either in course

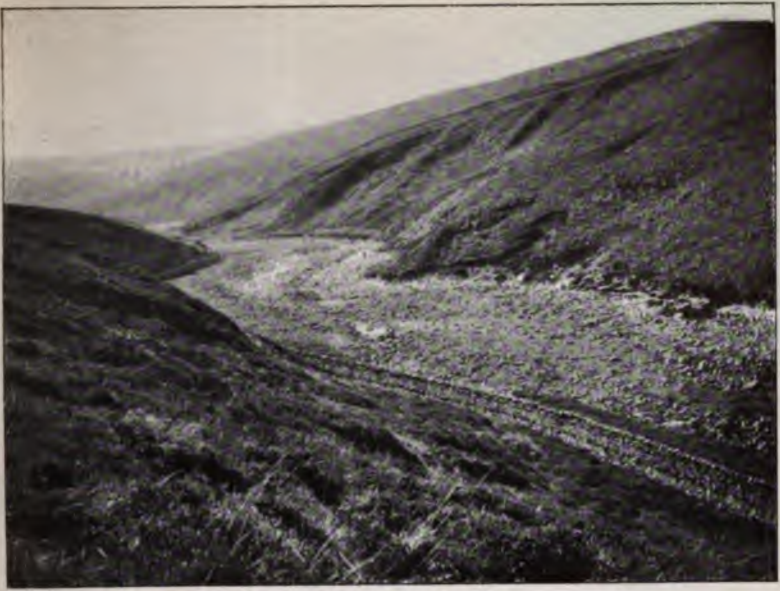

FIG. 7. Calluna slopes in Cross Gill.

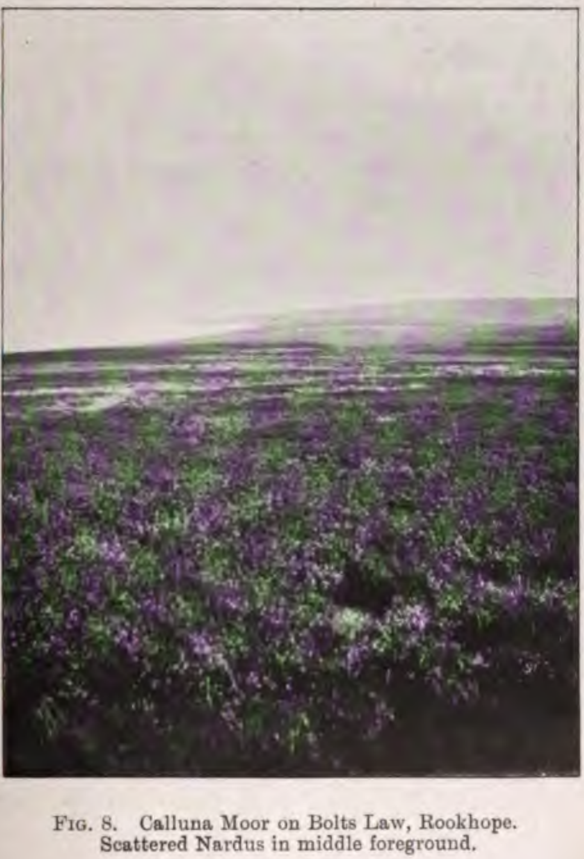

FIG. 8. Calluna Moor on Bolts Law, Rookhope.
Scattered Nardus in middle foreground.

of formation or already formed. Some of the valleys show striking contrasts in the vegetation covering the opposite slopes. In Upper Tynedale above Alston the eastern slopes are covered with dry grass heath, the dead stems of Nardus tinging them almost to whiteness in the latter months of the year, and contrasting strongly with the dark heather-covered fells of the Cross Fell chain on the west. A decided increase in grass heath takes place as we pass further eastwards. Weardale and many of the hopes leading from it are typical grass-heath valleys, and Nardus is generally prominent, although the upper part of the fells is covered with a wet association of *Eriophorum*, *Calluna*, *Rubus Chamæmorus*, and *Vaccinium Myrtillus*, sometimes degenerating into Eriophorum bog.

The upward limit of the grass heath and the lower limit of the heather formation coincide closely in many cases with the boundary of the limestone and shale beds. Limestone crags are in little evidence in the Weardale district, and, where developed at all, generally occur low down in the dale. Above 1500 to 1800 feet the limestone is largely replaced by thick beds of shale and flaggy sandstone, and it is on these latter that grass heath is replaced by heather associations. Looking eastward from St. John's Chapel, Weardale appears to be entirely grass-clad, and it is only on ascending above 1800 feet, and in some cases 2000 feet, that the whole of the watersheds are seen to be covered with wide-stretching moors dominated by the wettest types of heather associations. The same features are to be met with in upper East and West Allendale and in Harwood.

HEATHER ASSOCIATION.

The heather associations resolve themselves into three chief types, distinguished primarily by the relative abundance of Eriophorum and secondary plants.

(*a*) Heather moors developed on dry slopes and in most cases on shallow peat.

The plants forming this association are almost identical with those forming the Heather moors of Part I. A list of the typical plants is as follows :—

Calluna Erica, DC. Dominant.
Juncus Squarrosus, L.
Nardus stricta, L.
Deschampsia flexuosa, Trin.
Vaccinium Myrtillus, L.
V. Vitis Idæa, L.
Scirpus pauciflorus, Lightf.
S. cæspitosus, L.
Empetrum nigrum, L.
Galium saxatile, L.
Rumex Acetosella, L.

The area covered by this association shows a striking shrinkage from that of Part I. It forms in the present area an irregular fringe round the wetter types of Heather association.

(*b*) The Heather association occupying the largest area consists almost exclusively of *Calluna Erica* and *Eriophorum vaginatum.* Reference to the accompanying map will show that this association covers the whole of the sub-alpine region of Teesdale and all the sub-alpine heatherlands of Weardale. It is developed on the deepest peat, often underlaid with a well-formed moor-pan. The Calluna is somewhat stunted, generally not growing so high as the Eriophorum, which seems to flourish exceedingly well. No dry peat plants are to be met with in these areas, the only change in the vegetation being occasional colonies of such plants as *Vaccinium Myrtillus, Scirpus pauciflorus, Sphagnum* spp., *Rubus Chamæmorus, Empetrum nigrum.* Lichens are fairly abundant, the most plentiful being *Cladonia rangiferina.*

This association generally passes downwards into grass heath with Eriophorum or into Nardus grass heath, but with well-drained peat it passes into Calluna moor. Above the 2000-feet contour-line it changes into the Vaccinium and Calluna with Eriophorum (EVH) moor.

ERIOPHORUM BOGS.

Where the peat becomes very wet, with but few natural drainage channels, the Calluna almost entirely disappears, and the dominant plant is Eriophorum. Sphagnum may be present under these conditions, but is not generally a prominent feature in the vegetation, being confined chiefly to boggy pools and scattered patches amongst the clumps of Eriophorum. Denudation is usually rapid in such an area, and bare peat is common.

Some of the areas mapped as Eriophorum bogs appear to differ considerably from one another both in origin and present appearance, although both are dominated by cotton grass. In some places *Eriophorum vaginatum* is the dominant species, mixed with a very small quantity of Calluna, much stunted and only 2 or 3 inches in height. Some of such Eriophorum bogs appear to have been covered with a much greater quantity of Calluna at some former period, as the bleached stems may be seen partly buried among the now luxuriant Eriophorum. Most of the Eriophorum bog mapped at Black Band is of this character. It strongly suggests a burnt area of heather and Eriophorum moor (EH), the Calluna being replaced by the more rapidly growing Eriophorum. In other cases *Eriophorum angustifolium* is the dominant species, mixed with a smaller quantity of *E. vaginatum* and a few individuals of wet-peat plants, such as *Rubus Chamæmorus, Erica Tetralix,* and *Empetrum nigrum.*

The succession of the different types of sub-Alpine moorland are extremely well shown along some of the "edges" in Weardale and the neighbouring "hopes." At Redbourne Edge, in Rookhope, the summit moorland at 1850 feet is covered with Eriophorum bog, which farther towards the edge merges into heather and Eriophorum moor. The summit is almost flat, gently sloping to the east, and draining into

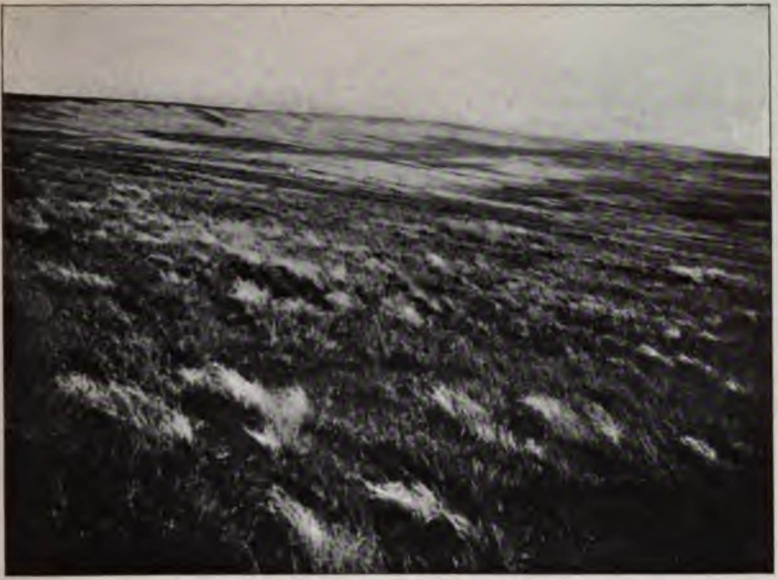

Fig. 9. Succession of moorland vegetation on Redbourne Edge. Eriophorum Bog on the summit plateau. Nardus Grass Heath developed on the slopes below, changing to Grass Heath with Eriophorum as the wet, gently sloping foreground is reached.

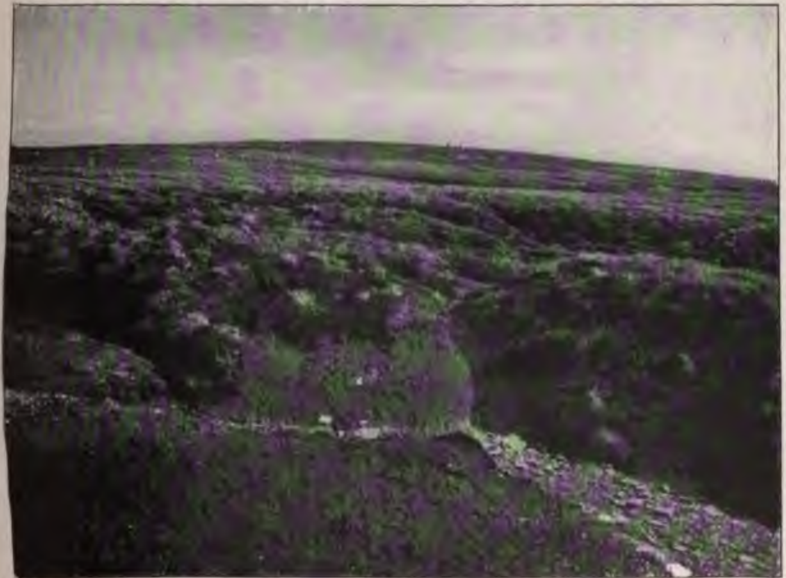

Fig. 10. Calluna and Vaccinium vegetation at summit of Deadstones. Eriophorum, Vaccinium and Calluna association in foreground.

East and West Allendale, and the underlying shale and sandstones are covered with deep wet peat, with numerous scattered pools of water between the clumps of Eriophorum. The only drainage is by channels which have been cut in the peat by rills. As the edge of the bog is approached the peat becomes drier, Eriophorum disappears, and the vegetation consists of a narrow band of Calluna moor. From here the ground slopes away sharply, and peat is absent, and upon this slope a typical Nardus grass heath is developed. As the slope merges into the gently inclined moor below, the soil becomes wetter, and peat again makes its appearance. As these conditions obtain, Nardus disappears, and its place is taken by a type of wet grass heath dominated by *Molinia, Deschampsia cæspitosa,* mixed with an almost equal quantity of *Eriophorum vaginatum.* This sequence of associations may be repeated several times before the bottom of the hope is reached.

Thus we have nearly all the chief types of grass heaths and Heather associations well shown within a few hundred yards of each other—Eriophorum bog upon the flat summit moorland yielding to Eriophorum and heather moors, and finally heather moor as the better-drained edge is reached, the dry peat-free slope being occupied by Nardus, which yields to the wetter type of Eriophorum grass heath as the flat terrace is reached. This alternation of moorland associations, where so sharply marked off as it is at Redbourne Edge, can be seen at a long distance, particularly in the latter months of the year, when the white Nardus heath stands out in vivid contrast to the russet-coloured Eriophorum bogs above and Eriophorum grass heath below.

Alpine Moorland.

The moorland of the Cross Fell chain is dominated by Calluna and Vaccinium, being the continuation northwards of the Alpine moorland mapped on Dufton Fell in Part I., and the lists which are given there of the dominant plants of the Vaccinium and Heather moors apply also to the Cross Fell moors on the present map. The only change that has been noted is a slight increase in the relative amount of Eriophorum present.

A much drier type occurs on rocky slopes with shallow peat, in which *Calluna* tends to disappear, *Rubus Chamæmorus* and *Eriophorum* are altogether absent, and the vegetation is made up of *Vaccinium Myrtillus, V. Vitis Idæa,* with *Juncus Squarrosus,* and a small quantity of *Nardus.* A nearly continuous strip composed of such an association extends along the south-west edge of the Cross Fell range from Melmerby Fell past Stoney Rigg to Brown Hill. South of this the vegetation changes to grass moor across the south-west slopes of Cross Fell, until High Scald Fell is reached, when *Vaccinium* again supersedes all other vegetation, and is continued with little interruption to Backstone Edge on Sheet I. This *Vaccinium* band lies very near and slightly above the 2000-feet contour-line for a distance of about 9 miles, and follows very closely the outcrop of the Whin Sill. Well-marked outliers of *Vaccinium* occur on the steep eastern face of Dufton Pike, Brownber Hill, and Roman Fell at 1950 feet on Sheet I.

Passing to the Weardale Fells, a change can be noted in the character of the Alpine moorland. *Calluna* is still abundant, but it is mixed with an increasing quantity of *Eriophorum* and *Rubus Chamæmorus*. This is particularly noticeable on the long stretch of moorland from Currick End to Three Pikes, forming the water-parting between the Tees, Wear, and Tyne. The whole of the ground here is formed of shales and flaggy sandstones, and is typically eugeogenous in character. The following list of plants represent almost the only vegetation occurring on this area:—

Calluna Erica, DC. Dominant.
Eriophorum vaginatum, L. Dominant.
E. angustifolium, Roth. Abundant in places.
Vaccinium Myrtillus, L. Generally distributed, but not abundant.
Rubus Chamæmorus, L. Everywhere abundant.
V. Vitis idæa, L. In drier spots, chiefly on the summit ridges.
Empetrum nigrum, L. Abundant.
Sphagnum, spp.

This list is typical of most of the Alpine moorland of the Weardale Fells, but considerable local changes occur. In some places on Burnhope Seat, Deadstones and Knoutberry Hill, *Rubus Chamæmorus* may cover the ground to the exclusion of all other vegetation.

Two well-marked varieties of the above association, which has been designated EVH on the map, can be recognized as occurring under different conditions of moisture.

(1) Under conditions of extreme moisture the *Eriophorum* becomes dominant, and *Calluna* and *Vaccinium* almost or entirely disappear, thus producing an Eriophorum bog almost identical with those found on the sub-Alpine moorlands, the chief difference being the greater abundance of *Rubus Chamæmorus* on the Alpine area. Many of these areas are small in extent, and merge almost imperceptibly into the surrounding EVH moor. The best example is to be seen at Yad Moss, on Burnhope Seat, almost the only plants to be found here being *Eriophorum angustifolium*, *E. vaginatum*, *Rubus Chamæmorus*. A number of surface drains have been cut here, and the drier conditions thus produced are rapidly restricting the amount of *Eriophorum* and tending to produce an EVH association. (2) On many of the dry, wind-swept summit ridges *Eriophorum* disappears, and *Rubus Chamæmorus* becomes much less frequent, the vegetation being composed of stunted *Calluna*, *Vaccinium Myrtillus*, and *V. Vitis Idæa*.

Over the whole of the Alpine moorland, and the greater part of the sub-Alpine moors above 1500 feet, there is striking evidence of the denudation to which the peat is being subjected at the present time. From the Baron Hills on Cross Fell, looking south-east, the eye takes in

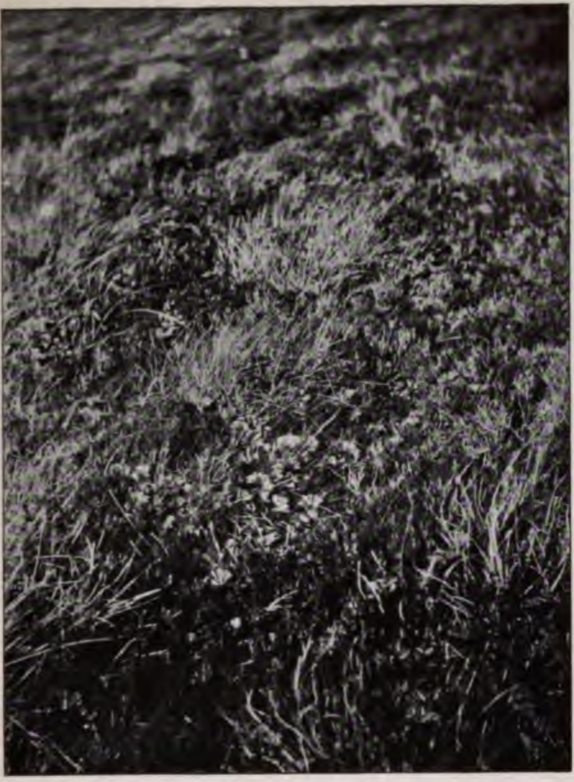

FIG. 11. Vegetation of Alpine moors. Eriophorum, Vaccinium and Calluna association with Rubus Chamæmorus, on Burnhope Seat at 2,300 feet.

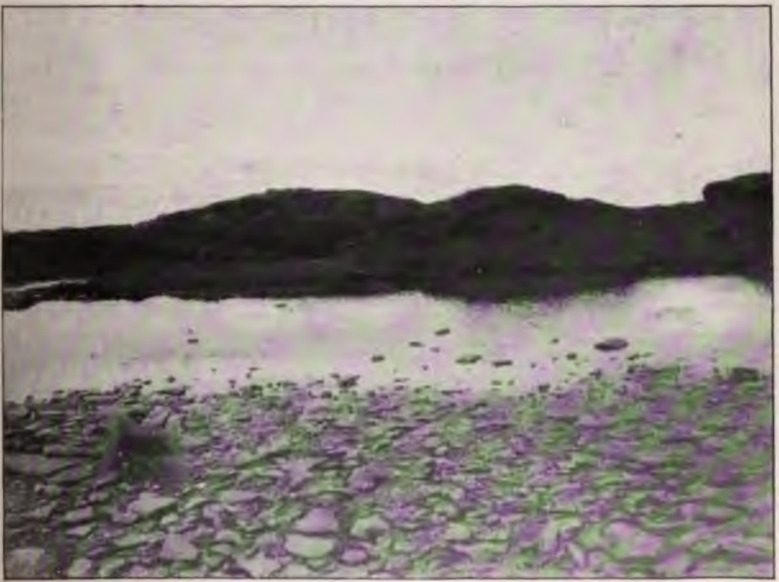

FIG. 12. Denudation of the Peat at Yad Moss at 2,300 feet.

nothing but the long stretch of moorland on each side of the Tees as far as the foot of the Weardale Fells, scarred and furrowed by deep channels cut in the peat, in some cases to a depth of 17 or 20 feet. In many places large areas of black peat are quite unoccupied by any vegetation and strewn over with the remains of ancient birch woods, which are continually being exposed as the peat wastes away. Although over much of this area the peat is of the average thickness of 20 feet, yet in some places the denudation has been so rapid that large areas of the underlying glacial clay are laid bare. The moorlands now under discussion have been altered less by artificial agency than any other part of the Pennines. They are far removed from any large towns, not used as water-catchment areas, untraversed by any roads, and unaltered by any attempts of reclamation. Heather-burning is carried on to a very limited extent, and not at all above 1800 feet. A few surface drains have been cut on some of the lower moors towards Hartside, and these appear to be rapidly restricting the amount of Eriophorum, but the only interference with the natural drainage to the south-east of Cross Fell for the first 8 miles of the course of the Tees is a few channels cut in the old mining days to feed three artificial tarns near Cashwell Mine and a few near Tynehead. So far from these accelerating the denudation of the peat, they would tend rather to retard it by carrying off the surplus water from springs in well-defined channels.

Sphagnum is generally distributed over the moorlands, but in most cases it forms quite a subordinate feature in the vegetation, and, as far as the writer could judge, very little peat seems to be forming at the present time.

At about 2200 feet on the east side of Cross Fell the heather association gives place to grass heath, which, however, is still mixed with a good deal of Eriophorum, with occasional patches of Calluna and Vaccinium up to 2500 feet, where the ground rises abruptly in a series of steep terraces, and the vegetation merges into drier grass heath. As the ground becomes more level near the summit plateau, occasional peat dunes make their appearance, the intervening ground being still covered with grass heath. These dunes are often more than 4 feet high, and are the only remains of a thick bed of peat which once covered the whole of the ground, and they afford good evidence that the climatic conditions have changed since the peat beds were in course of formation.

The summit plateau, at about 2900 feet, is occupied by a scanty vegetation, growing between the bare patches of peat and rock, composed of a few stunted members of the heather and grass heath associations, and boggy pools containing Eriophorum and Sphagnum. The higher and drier part of the plateau is covered with living and decaying *Racomitrium lanuginosum*, forming mounds of peat, weathered away to a vertical surface on the south-west side.

During the course of the survey many sections through the peat have been made on the Cross Fell range and on some of the Weardale Fells. The sections have sometimes been carried down to a depth of 17 feet to the base of the surface peat bed, and continued through 4 or 5 feet of glacial clay below, and a succession of plant beds varying in thickness from 2 to 8 inches has been exposed, separated by layers of stiff grey glacial clay.

The plant remains from these different inter-glacial beds is very dissimilar, and show that considerable climatic changes have taken place. The author is now extending these observations, and comparison will be made with the remains of peat beds outside the present area, both in Scotland and in Ireland, and the results will be given in future papers.

ALPINE GRASS HEATHS.

As the upper limit of the Calluna and Vaccinium moors is reached at about 2150 feet, the vegetation changes into Eriophorum and stunted Calluna, with much *Vaccinium Myrtillus*. As the ground becomes steeper and drier, this gives place to grass heath, whilst on the steepest slopes pasture is encountered. The vegetation over much of the Alpine grass heath consists of the following plants:—

Juncus squarrosus, L.
Deschampsia flexuosa, Trin.
Poa annua, L.
Nardus stricta, L.
Agrostis canina, L.
Molinia varia, Schrank.
Calluna Erica, DC.
Vaccinium Myrtillus, L.
Eriophorum vaginatum, L.

The Nardus of the sub-Alpine region is here largely replaced by *Juncus squarrosus*.

Alpine pasture is well developed on some parts of Cross Fell and Milburn Forest, chiefly on the dry limestone and sandstone bands. The most abundant grass on the former is *Sesleria cærulea*, which in some places forms the only vegetation, as on Stoop Band. Alpine plants are confined to spring heads, the sides of rills, and grassy places, and occur chiefly on the Cross Fell chain. The following occur in the present area:—

Thalictrum alpinum, L.
Draba incana, L.
Thlaspi alpestre, L.
Cochlearia alpina, H. C. Wats.
Dryas octopetala, L.
Saxifraga stellaris, L.
S. Hirculus, L.
S. hypniodes, L.
Sedum villosum, L.
Epilobium alsinefolium, Vill.
Galium boreale, L.
Arctostaphylos Uva-ursi, Spreng.
Vaccinium uligniosum, L.
Andromeda Polifolia, L.
Gentiana verna, L.
Bartsia alpina, L.
Polygonum viviparum, L.
Tofieldia palustris, Hud.
Carex rigida, Good.
C. capillaris, L.
Festuca vivipara.
Woodsia ilvensis, R. Br.

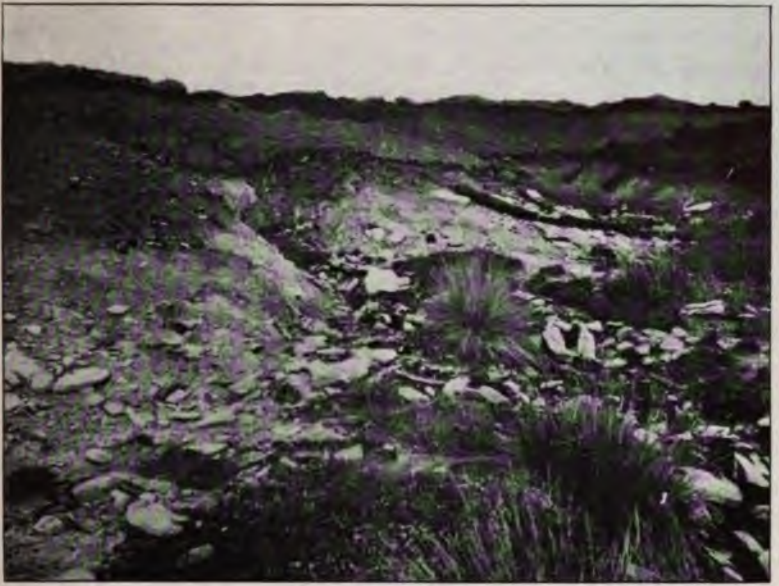

FIG. 13. Denudation of the Peat exposing Glacial Clay on Tynehead Fell at 1,800 feet.

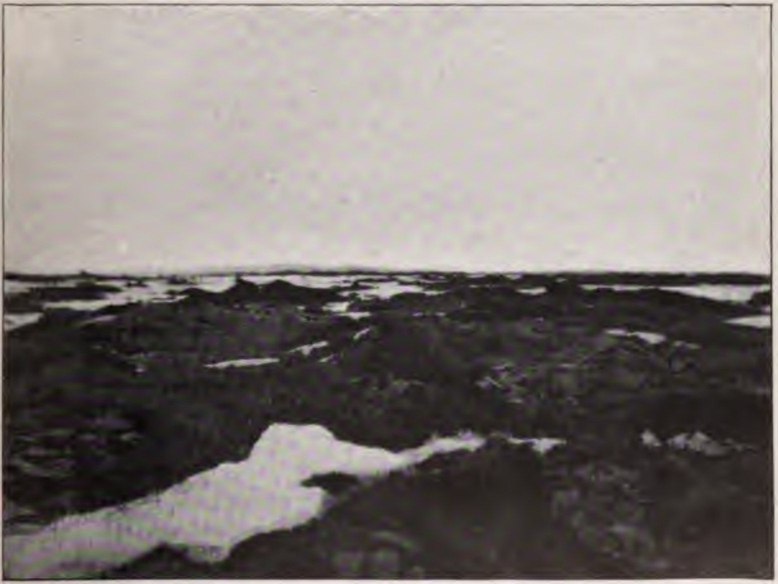

FIG. 14. Alpine plateau, Cross Fell.

SUMMARY.

The following tables give an analysis of the areas covered by the main types of vegetation in Part I. and Part II., and as the area of observation is extended northwards and westwards, such tables will give a ready means of comparing the vegetation of neighbouring districts :—

SHEET I.

		Square miles.	
Cultivation ...	... Oats and permanent pasture (O, OPa)	128	... 45½ per cent.
Woodland ...	... Deciduous woodland (D, OK, Bi) ...	4	... 1½ „
	Coniferous woodland (P, C) ...	3	... 1 „
Sub-Alpine ... Moorlands ...	... Natural pasture and grass heaths (Pa, GH, HGH)	62	... 22½ „
	Heather with Eriophorum moors (EH)	1½	... ½ „
	Heather moors (H)	45	... 16 „
	Sphagnum bogs (S)	5½	... 2 „
	Eriophorum bogs (E)	12	... 4¼ „
Alpine moorlands ...	Vaccinium and Vaccinium and heather moors (V, VH)	17	... 6 „
	Alpine grass heath and pasture (GH, Pa)	2	... ¾ „
	Alpine plateau	trace	
	Total	280	100 „

Total area over 2000 feet, 19 square miles.

SHEET II.

		Square miles.	
Cultivation ...	... Oats and permanent pasture (O, OPa)	63	... 22½ per cent.
Woodland ...	... Deciduous woods (D, OK, Bi) ...	1	... ¼ „
	Coniferous woods (P, C)	3	... 1 „
Sub-Alpine moors ...	Natural pasture and grass heaths (Pa, GH, EGH, HGH, VGH)	89½	... 32¼ „
	Heather moors (H)	25½	... 9¼ „
	Heather with Eriophorum moors (EH)	47½	... 17 „
	Eriophorum bogs (E)	13	... 4½ „
Alpine moorlands ...	Vaccinium and Vaccinium and heather moors (V, VH)	10½	... 3¾ „
	Eriophorum, Vaccinium and heather moors (EVH)	16½	... 6 „
	Alpine pasture and grass heaths (Pa, GH)	10	... 3½ „
	Alpine plateau (A)	½	...
	Total	280	100 „

Total area over 2000 feet, 41 square miles.

The percentages are expressed per cent. of the total of 280 square miles.

I am greatly indebted to Mr. H. E. Wimperis, B.A., ASSOC.M.INST.C.E., for making these measurements. The figures were obtained by means of a planimeter from the published botanical maps. The error introduced by the slope of the ground is in all cases quite small, rarely approaching, and never exceeding, 1 per cent.

In conclusion, it may be interesting to compare the two areas of the northern Pennines now surveyed with the southern Yorkshire Pennines surveyed by Messrs. Smith, Moss, and Rankin. The southern district presents a smaller extent of moorland than the northern, and at the same time is intersected by a larger number of cultivated areas. The flat-topped hills are covered with a dominant vegetation of Eriophorum bog, and in most cases only a narrow fringe of heather or grass moorland separates these bogs from the cultivated area.

On the more elevated moors of the northern region the Eriophorum bog is much less in evidence, and in its place we have a great development of heather and grass moorland (22 per cent. of the area) rising above 2000 feet into the upper zone of vegetation. Over much of these Alpine moors on the dysgeogenous hills, Calluna and Vaccinium are dominant plants, but Eriophorum again becomes conspicuous on the eugeogenous Weardale Fells. Well-marked areas have been mapped on Stainmore, where Sphagnum or the bog moss supersedes all other plants, but this association has not been recognized in the South Yorkshire district.

The range of the different associations in Part II. may be summarized as follows:—

I. *Region of Cultivation.*

1. With oats (no wheat), 450 feet to 800 feet. Only in the Eden valley and lower Weardale.
2. No oats. Permanent pasture reserved for hay: upper limit, 1950 feet.
3. Region of deciduous trees: upper limit, 1100 feet.

II. *Sub Alpine Region.*

1. Region of coniferous trees: upper limit, 2015 feet. Pine-remains in the peat at 2400 feet.
2. Birch copses: upper limit at the present time, 1200 feet. Extensive birch-wood remains up to 2700 feet.
3. Grass heaths, generally developed as an intermediate zone between the Alpine moors and the area of cultivation.
4. Natural pasture developed in patches or long bands on outcrops of limestone.
5. Heather moors only developed in a few places between the Eriophorum areas and the grass heaths.
6. Heather with Eriophorum moors covering nearly all the ground immediately below the Alpine moors.
7. Eriophorum or cotton grass bog in badly drained areas at all altitudes.

III. *Alpine Region.*

1. Vaccinium and heather moors developed on the dysgeogenous

hills, particularly the Cross Fell range: lower limit, 2000 feet; upper limit, about 2200 feet.

2. Eriophorum, Vaccinium, and heather moors developed on the eugeogenous hills of the Weardale watershed: lower limit, 2000 feet; upper limit, 2300 feet.
3. Alpine grass heath above the Vaccinium and heather moors.
4. Alpine pasture on limestone exposures well developed at Raehow End, on Ousby Fell, and Millburn Forest.
5. Alpine plateau on the more exposed summits.

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In Dr. Otto Pettersson's Paper, salinity and chlorine should everywhere read "per mille" and not "per cent."

ON THE INFLUENCE OF ICE-MELTING UPON OCEANIC CIRCULATION.

By Dr. OTTO PETTERSSON.

The circulation of oceanic waters has been ascribed partly to physical causes, such as the heating of surface waters in tropical and the cooling in polar regions, partly to mechanical causes, such as the influence of the prevailing winds. The latter is at present regarded as the chief motive power of the currents of the sea. In either case the *vis movendi* must be the effect of a thermodynamic cycle of the free heat in the atmosphere or in the hydrosphere. On the mechanical hypothesis, it is obvious that the primary effect is the generation of surface currents (wind-currents) of great intensity, and that the intensity of motion must decrease with the depth.

The general conviction at present is that the movement of the bottom waters of the ocean is extremely slow (*vide* G. Schott's description of the results of the German *Valdivia* expedition).

In 1878 I pointed out that a great—and probably the greatest—part of the oceanic current system must be due to another cause, viz. the thermodynamic cycle of latent heat, consisting in the formation of ice in polar regions, and the melting of ice in sea-water at lower latitudes.*

The melting of ice in sea-water gives birth to a system of currents and under-currents, of which the following diagram will give a schematic representation: †—

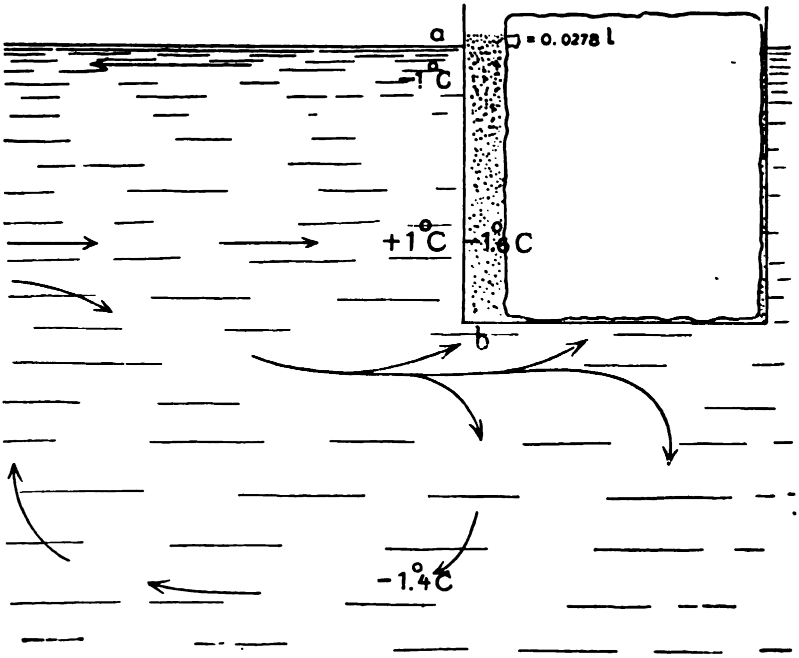

FIG. 1.—SCHEMATIC REPRESENTATION OF THE MELTING OF ICE IN SEA-WATER.

Imagine an ice-block floating in water of +1° C. temperature of 35 per cent. salinity. If the block is of rectangular shape, and its submerged part is L metre in depth, the height of the free part of the ice which rises above the water will be 0·1185L.

Imagine the ice to be enclosed in a thin box of perfectly conducting metal, wherein it melts. If the ice-water is allowed to escape through an aperture at *a*, and the sea-water to enter from below through another aperture in the bottom at *b*, then the ice-water will rise, forced up by the superior hydrostatic pressure of the salt water, and spread over the surface of the sea. The sea-water acts like the piston of a pump, and the work of this pump-stroke we find by an easy calculation to be 0·0139L kilogrammetre for every kilogram of ice melted.

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* *Öfvers. Kgl. Vetenskaps Akademiens Förhandl.*, 1878, No. 2, p. 61; and 'On the Properties of Water and Ice' (Vegaexpeditionens iakttagelser, Stockholm, 1883).

† For the particulars of this deduction, see the paper, "Die Wasserzirkulation im Nordatlantischen Ocean," *Pet. Mitt.*, 1900, Heft. III. and IV., p. 7.

The calculus * shows—

1. That the amount of work set free at the melting of ice in salt water is proportional to the specific gravity of the water. When the density of the water is = 1, it becomes nil, *i.e.* the melting of ice in fresh water produces no mechanical effect.

2. That the energy is proportional to the depth of the submerged part. If we calculate the effect of the melting of a kilogram of ice from an Antarctic iceberg drawing 500 metres of water, the energy will be equal to about 7 kilogrammetres. The energy stored up in the system ice and salt water is entirely transformed into motion of the water, *i.e.* to the generation of oceanic currents. It is a notable characteristic of the transformations that belong to the cycle of latent heat, that no deterioration or loss of heat takes place.

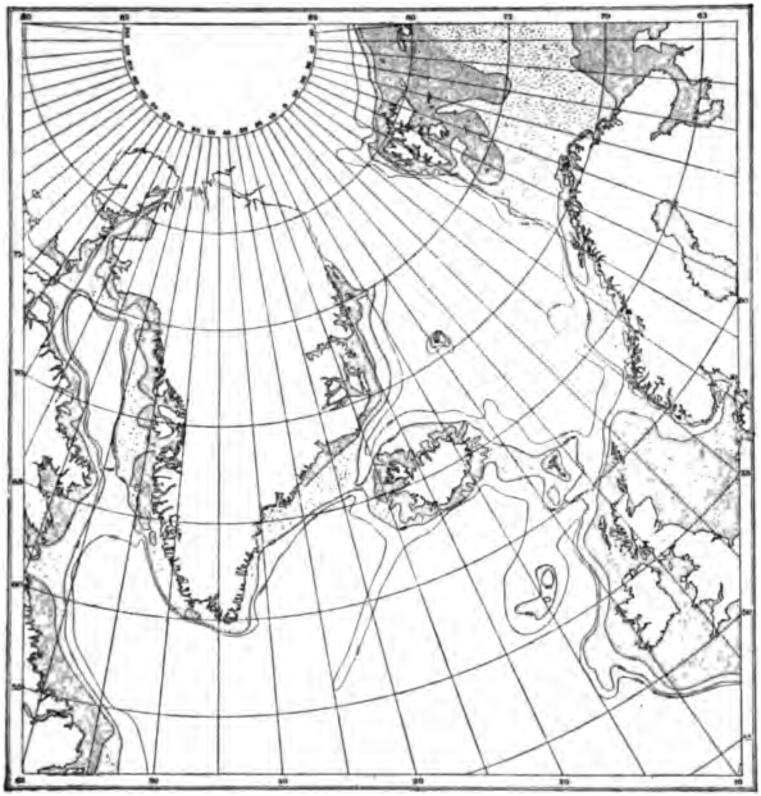

FIG. 2.—BATHYMETRIC CHART.

The heat which maintains the ice-melting process is supplied from the surrounding water, which is cooled to $-1{\cdot}90°$ C.† in contact with the ice. It partly mixes with the ice-water, thereby forming a surface current of cold diluted water ("polar" currents). Partly it sinks to the bottom, after having given up its surplus of heat to the ice. This cooled water forms the bottom layer of the oceans. The diagram indicates this system by arrows.

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* See *Pet. Mitt.*, 1900, *l.c.*

† According to M. Knudsen's last determinations. See 'Publications de circonstance No. 4 du Conseil permanent international pour l'exploration de la mer.' Copenhague, 1903.

It is evident that the water in the immediate vicinity of the ice cannot maintain the ice-melting process long. The sea-water which has given up its surplus of heat to the ice either ascends or descends, and is replaced by an inflow of new water, which necessarily must take the shape of a warmer under-current of what we, in our hemisphere, may denominate as "Atlantic" water between the cold diluted surface layer and the cold bottom layer of "Arctic" water. According to this nomenclature, *Arctic water is mainly Atlantic water which has been metamorphosed by ice-melting.*

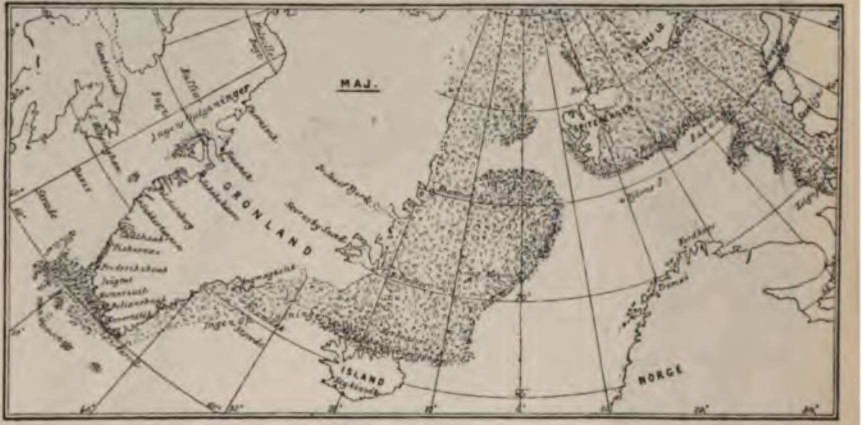

FIG. 3.—ICE-CHART FOR MAY, 1896.

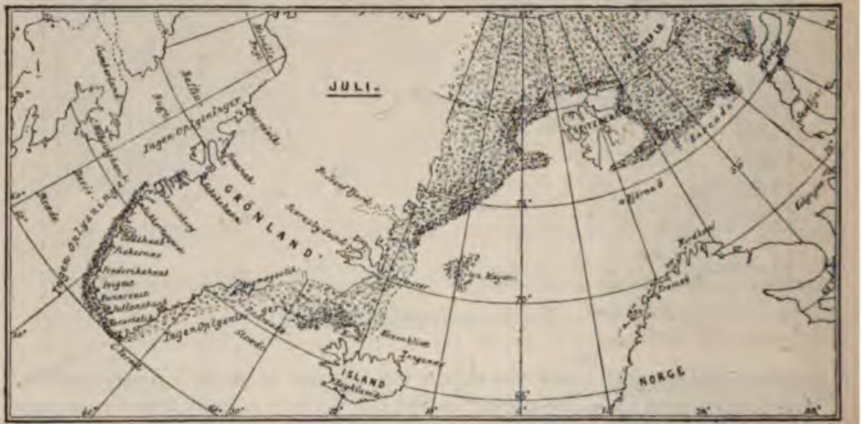

FIG. 4.—ICE-CHART FOR JULY, 1896.

In the vicinity of the ice we thus have Arctic surface water (cold and diluted) and Arctic bottom water (cold and very little diluted), and between both Atlantic water. Every deep sounding hitherto made in the ice-filled regions of the ocean bears out the fact that there exists a maximum of temperature and salinity (not of density) under the ice and waters of the polar current—N.B. if the depth is sufficient to allow the triple system of currents to develop. Wherever the depth is too shallow to permit the warm under-current to enter, the ice of the polar currents is carried unaltered down to lower latitudes. Therefore ice-currents always follow the continental shelf (*e.g.* the coasts of Greenland and Labrador). Wherever an ice-current has to pass over a deep part of the sea (*e.g.* Baffin's bay, south of Newfoundland, etc.), its ice-masses are vigorously attacked by the warm under-currents which always follow the trend of the deepest isobathic lines.* The ice-current dissolves into a cold-water current; or gives birth to a cold-water area which extends over great parts of the ocean. Consequently the ice-melting process in the oceans is localized to the meeting-places of ice-currents with warm under-currents. One such place is the sea between Iceland and Jan Mayen.

From the following sea-chart we infer that a broad channel, up to 1900 metres deep, extends from the deep region of the Norwegian sea between Iceland and Jan Mayen to the coast-bank of Greenland, over which the polar current wafts its icefloes towards the entrance of the Denmark strait, which, at its narrowest part between the north-western promontory of Iceland and Greenland, is very shallow. The ice, crowded together here, finds an escape through the deep channel between Iceland and Jan Mayen.

In March and April the ice-drift usually occupies the greatest part of this channel, and occasionally sends floes and blocks of ice down to the eastern and even to the southern coast of Iceland. Such was the case in April, 1903. In the following months, however, the influence of a warm under-current, a branch of the great Atlantic warm-water current of the Norwegian sea (*alias* "Gulf Stream"), begins to manifest itself by the melting of the ice between Iceland and Jan Mayen. The following charts, borrowed from the publications of the Danish Meteorological Institute, show how an area of not less than 90,000 square miles was cleared from ice in the time from May to July, 1896.

From the excellent hydrographic deep soundings of the Danish Ingolf Expedition, I have calculated the energy generated by the ice-melting in summer between Iceland and Jan Mayen to be equivalent to about 400,000 H.P. It can be resembled to that of a waterfall where the water, instead of descending, ascends from below to the surface. Thereby the waters of a mighty cold-water current, the "East Iceland polar current," are accelerated in a south-easterly direction, contrary to that indicated by the influence of the Earth's rotation, towards the Färoe islands. The velocity of this current was calculated to be 6·9 cm.-sec. (direct measurement by floats indicate a velocity of 8·4 cm.-sec.), and that of the under-current to be 2·9 cm.-sec. in the contrary direction.†

Both currents are represented—the warm under-current by a broad line, the cold surface current by a number of finer parallel lines, on the following chart, which is a schematic representation of the current system of the North Atlantic and the Norwegian sea. Full-drawn lines denote surface currents, dotted lines under-currents.

In the Atlantic proper, south of Iceland, we notice the ramifications of the great Atlantic warm-water current. Each of these branches proceeds northwards, following the direction of one of the deep troughs of the Atlantic (cf. the bathymetric chart). Two of these branches enter into the North sea, one through the Channel, the other north of the Orkneys and Shetlands. From the latter an under-current penetrates into the Skagerack over the North sea plateau, following the western and southern side of the Norwegian channel.

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* This tendency of the warm under-currents to follow the deepest troughs of the ocean must be ascribed to the influence of friction. It is obvious that a body of water which moves between two other layers of water in a direction opposite to them must be influenced considerably by friction, and take the line of least resistance.

† This was the number calculated by W. Ekman, *Pet. Mitt.*, *l.c.*

Next we have the great warm-water current of the Norwegian sea which enters over the Wyville Thomson ridge, its access to the Norwegian sea over the Iceland-Färoe bank being usually stopped by the East Iceland Arctic current (see the chart), which skirts the northern side of this bank, and sends an under-current in the shape of a submarine waterfall over the Iceland-Färoe and Wyville Thomson ridge into the depths of the North Atlantic, and likewise another under-current as an updrift of cold Arctic water over the North sea plateau east of Shetland. A third branch enters through the Norwegian channel into the Skagerack. By the alternate inflow of Atlantic and Arctic water, the fish-life and the distribution of the plankton in our seas is determined.

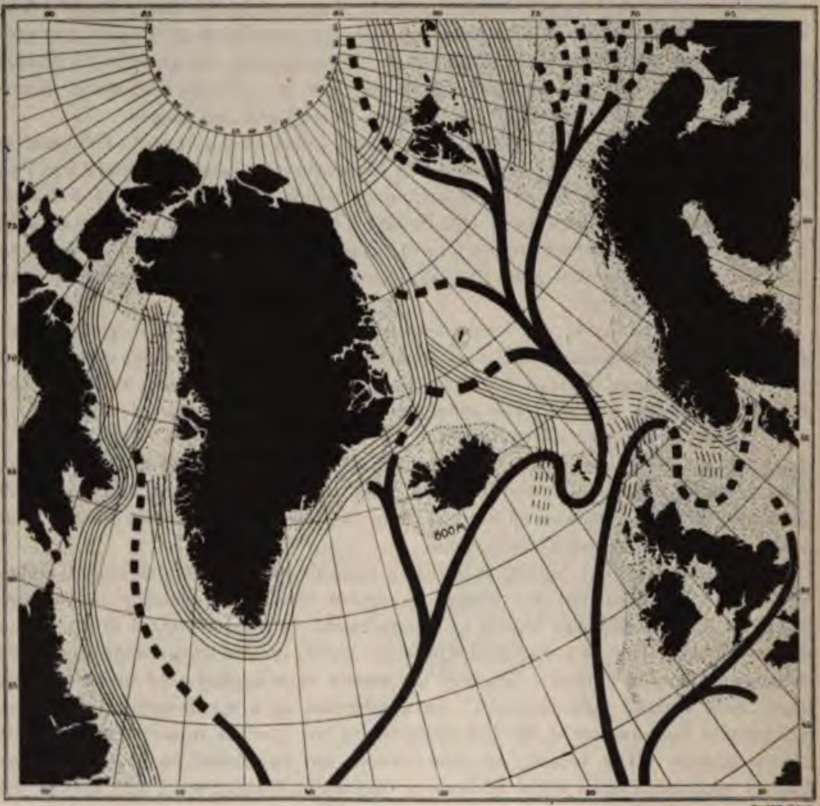

FIG. 5.—NORTH ATLANTIC CURRENT CHART.

In the middle part of the Norwegian sea the velocity of the Atlantic current abates, and a great accumulation of warm water of southerly origin takes place which can attain a thickness of up to 800–1000 metres, according to the deep soundings of Mohn, Nansen, Hjort, and others. The core of this body of Atlantic water was found about 0° long. in the summer of 1900. From this centre under-currents branch off westwards and northwards, always following the direction of the deepest channels of the Norwegian sea. One of these under-currents penetrates into the deep channel between Iceland and Jan Mayen, another takes a north-westerly direction towards the coast of Greenland; the main part of the Atlantic water continues its way northwards west of Spitzbergen, and enters into the deep polar basin, where Nansen discovered it at about 200 metres' depth.

A considerable part of the Atlantic current enters into the Barentz sea between Norway and Beeren island. The chart gives a representation of the current system of this sea according to the recent Russian investigations.*

The branch of the Atlantic current which enters the Barentz sea is the only one that seems to follow the easterly trend imparted to its waters by the Earth's rotation. All the other branches seem to be emancipated from this influence by a stronger attraction acting in the opposite direction. A similar observation can be made with regard to the East Iceland polar current, which takes a south-easterly direction, although it, as a south-going current, ought to show a tendency to keep close to the coast of Greenland. The power which counteracts the influence of the Earth's rotation is the attraction which the ice-melting process that is going on at the western side of the Norwegian sea exerts upon the warm water in the eastern and middle part of that sea. Another example of a north-going current which is deviated westward is the Irminger current south-west of Iceland, and the under-current of Davis strait and Baffin's bay.

Carpenter, from the observations of the *Valorous*,† signalled the existence of a thick layer of relatively warm water in Davis strait up to 63° N. lat. The observations of the Danish cruisers *Hekla* and *Ingolf* corroborate this statement. In 1883, A. Hamberg,‡ hydrographer to the Nordenskiöld expedition to Greenland, proved the existence of a layer of Atlantic water of +0°·4 to +0·9 C. temperature between two ice-cold layers of Arctic water at 400–500 metres as far to the north as 74° and 75° N. lat. in Baffin's bay. For Baffin's bay and Smith's sound we have further evidence of the existence of an Atlantic under-current in the following words of E. L. Moss: §—

"The channels between the polar sea and Smith's sound contain two strata of sea-water not owing their temperatures to local causes—an upper stratum of polar water overlies a warmer northward-flowing extension of the Atlantic."

From the scanty material of trustworthy deep soundings scattered in the enormously vast literature of narratives of Arctic explorations, I have constructed the schematic representation of the current system of the North Atlantic on p. 290.

The irretrievable fact that there exist under-currents of warm Atlantic water in the western tributaries of the North Atlantic bears evidence in favour of the theory here propounded. If there were no other forces in action except the winds, differences of level, of temperature and density, etc., the oceanic circulation in the North Atlantic would assume the regular cyclonic character so elaborately delineated in Mohn's great work.‖ The influence of the Earth's rotation would keep the north-going Atlantic water at the east and the Arctic water at the west side of the ocean.

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* N. Knipowitsch, "Zur Kenntniss der geologischen Klimate," *Verhandl. d. k. Russ. Mineralogischen Gesellschaft*, Bd. xl. 11.

† *Proc. R. Soc.*, vol. 25, 1876–77, p. 230.

‡ *Bih. K. Svenska Vet. Ak. Handl.*, Bd. 9, No. 16, p. 53.

§ *Proc. R. Soc.*, vol. 27, 1878, p. 545.

‖ H. Mohn, 'The North Ocean, its Depths, Temperature, and Circulation.' The Norwegian North-Atlantic Expedition, 1876–78. Christiania, 1887.

A closer inspection of the actual state reveals that there must be a flaw somewhere in the existing theory. If we consider the motion of the surface waters of the Norwegian sea as borne out by the charts of floats set free by the *Ingolf* expedition [*] and the expeditions of Nathorst,[†] the buoys of André and others, we find a close resemblance between the tracks of these floats and the current chart on plate i. in Mohn's work. But if we take also into account the qualities of the water in motion, viz. its temperature, salinity, and plankton, we shall find that the main body of Atlantic water does not flow close to the Norwegian coast, not even close to the Norwegian coast bank, but takes a more westerly course, leaving a broad area of water of mixed origin (Atlantic, Baltic, Arctic water + effluvies from the rivers and fjords, etc.) between itself and the Norwegian coast. This area is characterized by *neritic* plankton: *Tripos* plankton Tp (Cleve) in the southern part and North sea; northern neritic plankton Ns (Cleve) in the northern part, while the Atlantic water contains oceanic plankton, *Styli, S.*; *Chæto, C.*; *Tricho, T.* (Cleve).[‡]

From this body of Atlantic water which, by some influence that counteracts the easterly trend imparted to the water by the Earth's rotation, is deflected to the north-west between 66° and 69° of latitude, the under-currents mentioned on p. 290 branch off in the following directions:—

1. To the west, following the deep channel between Iceland and Jan Mayen.
2. To the north-west towards the east coast of Greenland.
3. To the north towards the north polar basin, following the west side of the coast bank of Beeren island and Spitzbergen.
4. To the east towards Barentz sea.

Each of these under-currents of Atlantic water will be discussed separately in the following. The existence of under-currents of warm water in the North Atlantic can be traced—

At the surface—by great edentations in the ice-filled area of the sea. The great bights in the ice well known to whalers and Arctic explorers are caused by such under-currents. The ice-chart for May, 1896, on p. 288 gives an illustration of this.

At intermediate depths—by the maximum of salinity and temperature, which, as a rule, is found in all deep soundings in Arctic regions between about 60 and 300 metres. From the temperature series of the *Ingolf* expeditions between Iceland and Jan Mayen, and from the discovery of a layer of more than 0° C. temperature under the polar current on the coast bank of Greenland by Captain Ryder, I was led on the track of the two under-currents here enumerated as Nos. 1 and 2. The under-current west of Spitzbergen (No. 3) was discovered by Mohn in 1878. The under-currents of the Barentz sea have been studied most elaborately by the Russian hydrographic commission.

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[*] 'Den Danske Ingolfexpedition,' i. C. F. Wandel.

[†] 'Expedition de A. G. Nathorst, Recherches oceanographiques par F. Åkerblom.' Upsala Univ. Arsskrift, 1903.

[‡] Cleve in his description of the plankton of the Scottish expedition with the *Research* in 1896, was the first to distinguish the two different plankton areas in the eastern part of the Norwegian sea. His observations concern, however, only the region north of the Wyville Thomson bank. A complete biological survey of the plankton of the surface water of that sea was made in 1900 by J. Hjort and H. Gran (see *Pet. Mitt.*, 1901, iv. pp. 73–83).

At the bottom—by the prevalence of CaO in the bottom deposits. It has been said before that Atlantic water undergoes a metamorphosis in contact with ice, so that Atlantic water which has taken an active part in the melting of polar ice assumes the characteristic properties of arctic water, not only with regard to its temperature, salinity, density, etc., but also with regard to its gaseous contents and the character of its plankton. Sir John Murray has first called attention to the fact that the foraminifers, radiolarians, etc., which form a prominent part of the plankton of the Atlantic water, perish when this water comes into contact with the water of the polar currents. Their calcareous shells then sink to the bottom.

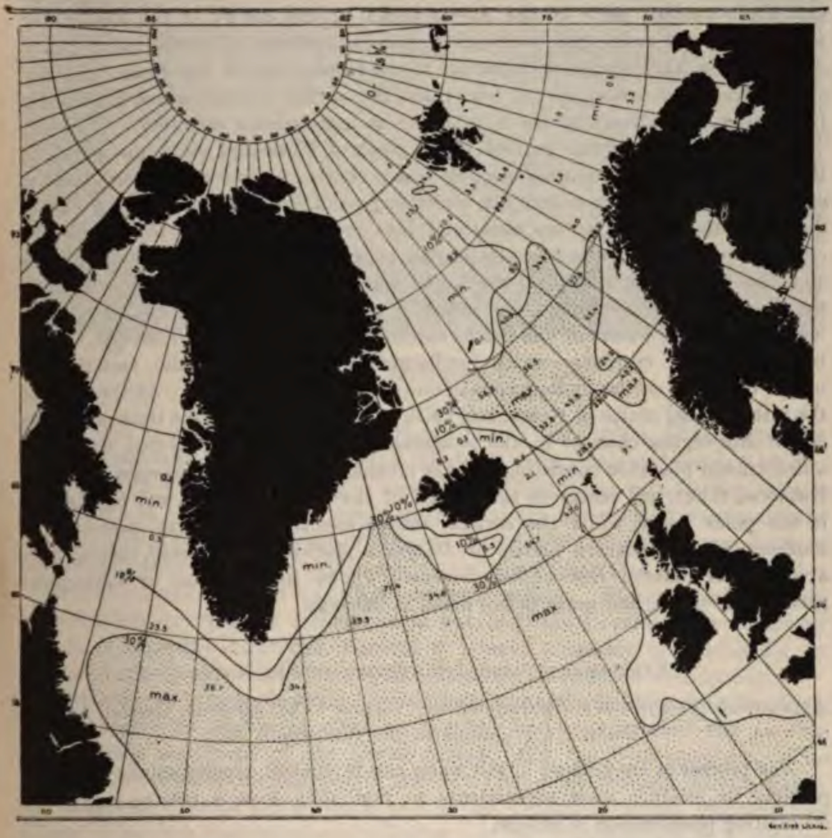

FIG. 6.—CHART SHOWING THE PERCENTAGE OF CaO IN THE BOTTOM DEPOSITS.

In accordance with this observation, we find, from an inspection of this chart, which I have compiled from the results of the *Challenger*, the *Vörringen*, and the *Ingolf* expeditions, the path of every under-current of Atlantic origin marked out by a relatively high percentage of CaO (above 40 per cent.) in the bottom deposit. All the currents here mentioned, the under-current of Davis strait, the Irminger current west of Iceland, and the under-currents Nos. 1–4 of the Norwegian sea have left their marks upon the sea-bottom in shape of calcareous deposits. Special attention must be drawn to an isolated patch of the bottom at 77°–78° N. lat.

west of Spitzbergen, richly covered with shells of globigerinas, etc., which marks the path of the under-current No. 3 of the north polar basin. On the other hand, we can expect to find the track of arctic currents on the sea-bottom in the shape of characteristic deposits of silicious ooze and clay, since the main plankton of the Arctic water consists of diatoms, *Sira-plakton*, *Si* (Cleve). The excellent chart of the bottom deposits of the Norwegian sea, drawn by the chemist of the *Vöringen* Expedition, Mr. Schmelck,* is an illustration of this.

In the preceding I have shown that under-currents of Atlantic water can, in spite of the influence of the Earth's rotation, be deflected to the remotest western and north-western parts of the Arctic ocean by the energy of the ice-melting process. By the same agent currents and under-currents of Arctic water can be deviated from their course and directed to the eastern side of the ocean. Among such currents we notice, in the first place, the surface current which flows along the eastern and southern coasts of Iceland in an anti-cyclonic direction.

The East Iceland polar current which north of Färoe dips under the waters of the Atlantic current is another example (see p. 289). A close connection seems to exist between this current and the under-current of Arctic water which from the depths of the Norwegian sea penetrates into Skagerack through the Norwegian channel. As we may infer from the current chart on p. 290, Skagerack receives also an inflow of Atlantic water over the North sea plateau, which likewise arrives in the shape of an under-current, the surface of Skagerack being—at least in summer—covered by the waters of the Baltic current emerging from the Kattegat. This triple system of currents—which furthermore is liable to periodic variations—makes the study of the hydrography of our seas very complicated. At the time of the international cruise in November, 1903, the water-layers of the innermost part of the Norwegian channel in the Skagerack, from 30 to 300 metres, contained a rich animal plankton consisting of large crustaceans of the same species found by Nathorst, Hjort, and others in the depths of the Norwegian sea, and by Nansen in the polar basin, while the surface waters teemed with vegetal plankton of southern origin: southern neritic or *Didymus* plankton, *Di* (Cleve), mixed with a species of diatom, *Biddulphia chinensis*, known from tropical or subtropical parts of the ocean, and never before found in our seas.

EXPERIMENTS WITH ICE-MELTING IN SEA-WATER.

Application of Bjerkne's Hydrodynamic Theory—The General Outlines of the Oceanic Circulation in the Norwegian Sea.

The process of ice-melting in salt water can be studied experimentally, and it is possible to conduct such experiments so that they have a bearing upon the ice-melting phenomenon in nature.

First I will describe some very simple lecturing experiments which can be projected upon a screen in order to give a general idea of the different system of currents generated by ice-melting in fresh water and in sea-water.

A small parallelopipedic tank with transparent sides is filled with water. Five glass tubes, each containing a fragment of a crystal of permanganate of potassium dip into the water, each giving birth to a tiny jet, intensively coloured, which descends perpendicularly to the bottom. Now introduce a small piece of ice at one side of the tank. The image which appears upon the screen will be very different if the experiment is made with fresh water or sea-water. In both cases the jets are deflected towards that side of the tank where the ice is placed. The characteristic features of each series of experiments is, that there is no trace of an outgoing surface current in fresh water which appears very distinctly in salt water.

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* 'The Norwegian North Atlantic Expedition, 1876-78,' Chemistry, i.

In fresh water we observe the usual convectional currents which appear in every liquid when cooled or heated; the water sinks at the cooled side of the tank and rises at the other. In salt water the currents have the appearance shown in the following figure:—

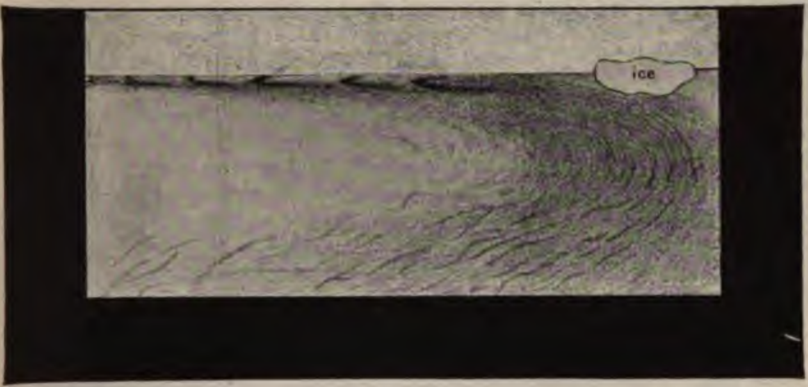

FIG. 7.—ICE-MELTING EXPERIMENT.

We can discern three different currents: one on the surface, which flows from the ice; another current at intermediate depth runs straight towards the ice; while a third current, consisting of water cooled by contact with the ice, follows the bottom of the tank. The triple-current system in our tank represents the polar current, the under-current of Atlantic water, and the cold bottom water of the western parts of the Norwegian sea. Analogies of this kind invited to further experiments combined with quantitative determinations. The essential condition for obtaining quantitative measurements was, however, to establish a stationary system of currents. For this purpose it became necessary to provide for an unlimited supply of ice and of sea-water of constant temperature and density.

Moreover, it became desirable to make an alteration in the outfitting of the tank, in order to realize as much as possible in an experiment the peculiar hydrographic conditions of the North Atlantic and the Norwegian sea. The characteristic feature of these seas is the submarine ridge between Iceland, Färoe, and Scotland, whereby the northern part of the Atlantic is divided into two deep basins. The tank was consequently divided into two compartments by a partition shown in the following figure (p. 296). In the outer (Atlantic) compartment an extra current of sea-water of the same temperature and salinity was allowed to circulate with constant velocity. At the end of the inner compartment was placed a cage of galvanized iron wire containing ice. At four places indicated by vertical lines in the figure, the temperature, salinity, and density of the water at 2, 4, 8, 12, and 16 cms. depth was determined.

The contrivance used for this purpose, a sledge with cog-wheels, pipettes, thermometers in the shape of an L, need not be described here. The water was purposely not filtered. By observing the motion of the small particles held in suspension by the water, I was able to estimate approximately the velocity of the currents at different depths. The experiment was made in the great cellar vault of the laboratory, where the temperature was almost constant. The sea-water (about 30 litres) was kept in a wooden barrel, and carefully stirred before the beginning of the experiment. The initial temperature was = 5°·52 C., salinity =33·45 per cent. Before the introduction of ice, the extra current was allowed to flow regularly for two hours through the outer compartment with a velocity of 0·7 cm. to the second. This circulation caused little or no motion of the water in the other compartment. After the introduction of the ice, the formerly stagnant waters of this compartment began to flow with considerable velocity; the surface water and the bottom layer *from* the ice, the intermediary layer *towards* the ice. In a second experiment a sponge with a few crystals of malachite-green was fastened before the orifice of the tube, in order to make the course of the extra current visible. So long as there was no ice in the inner compartment, the water there was clear and transparent unto a few centimetres from the partition, while the waters of the outer compartment were intensely coloured. With the introduction of the ice the state of things was changed. The water of the extra current was deflected to the right in the shape of a well-defined under-current, which passed about 1 cm. over the partition wall straight towards the ice. Here the coloured tongue of water parted in two, one part rising to the surface, where a rapid current, flowing at the rate of 2 cms. to the second, brought the water back to the outer compartment and to the exit tube. The other part sank down from the ice to the bottom. The bottom water flowed towards the wall, where it seemed to accumulate until it reached the level of the partition and found an escape over it into the outer compartment under the ingoing current—a striking illustration of the description * of the outflow of the waters of the east Iceland polar current over the Färoe-Iceland and Wyville Thomson submarine ridge *under* the Atlantic current, which runs in the opposite direction over the ridge into the Norwegian sea.*

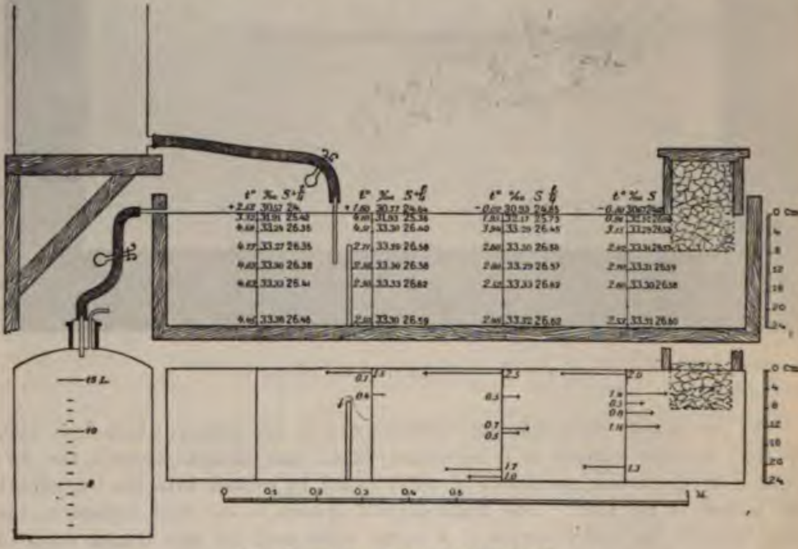

FIG. 8.—ICE-MELTING EXPERIMENT.

The rising tendency of the bottom water at the right side of the submarine ridge is proved by its relatively low density (1·02659) at 24 cms. depth. At 16 cms. the density of the water *in situ* was found to be 1·02662. The observations in the vicinity of this place are too few to admit a calculation of the dynamical conditions; but it nevertheless seems probable that in similar places in the ocean—*e.g.* at the northern side of the Wyville Thomson bank—the motion of the deep water takes the shape of a vertical vortex or eddy.

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* See M. Knudson, 'The Danish *Ingolf* Expedition.'

The influence of the cold under-current which passes over the ridge is shown by the lower temperature 4°·45 C., and the higher density 1·02645 at the bottom of the other compartment. The cold under-current which passes over the Iceland Färoe bank has a similar effect upon the temperature of the bottom water on the Atlantic side of the bank, according to M. Knudsen.

The numbers in the diagram on p. 296 refer to measurements made eight hours after the introduction of ice in the second compartment, when the triple current system had become stationary. The maximum of temperature corresponding to that which characterizes Arctic seas was situated at a depth of 4 cms. in the two "stations" nearest to the ice. The temperature series from the "stations" in our experiment has a striking analogy to certain well-known temperature series obtained by deep soundings in Arctic and Antarctic seas. See the diagram, Fig. 9.

The only essential difference is that the temperatures in the experiment on the whole were found to be higher than in the deep soundings. We must remember that the temperature depends (1) upon the distance from the ice, (2) upon the rate at which the supply of warm water to the ice takes place. If the extra current in our experiment had flowed less abundantly, we should have attained a temperature series similar to those observed in the ocean, but in that case it would have lasted weeks before the stationary state had been reached. From the experience now gained, I felt convinced that it would be possible to conduct an experiment in

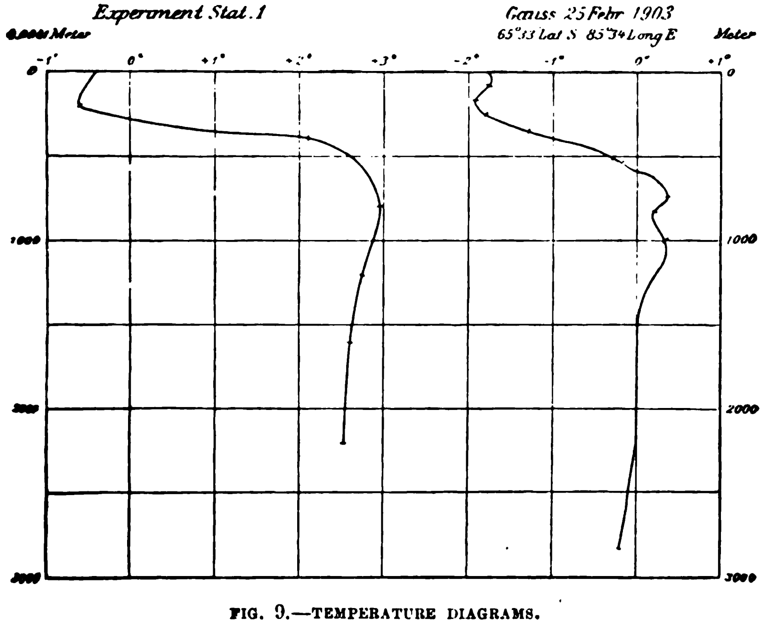

FIG. 9.—TEMPERATURE DIAGRAMS.

such a manner that it would present a stringent analogy to the ice-melting phenomenon in nature, and open the way for mathematical discussion of such phenomena. The theoretical problem can be attacked from two sides, viz. from a thermodynamical or from a hydrodynamical point of view. In my former paper in *Petermanns Mitteilungen* I had, from elementary thermodynamic principles, calculated the energy developed by the ice-melting process in summer between Iceland and Jan Mayen, which maintains the East Iceland polar current, to be about 400,000 H.P. This time the problem seemed to fall more within the limits of hydrodynamics, since the object was to locate the accelerating forces of the oceanic circulation of the North Atlantic. For such purpose I requested Mr. J. W. Sandström, First Assistant to the Swedish Hydrographic Commission, to repeat the experiment on a larger scale in the Central Laboratory for Oceanic Research at Christiania with a large tank, which Prof. F. Nansen kindly placed at my disposal, in such a manner that the result could be calculated according to the principles of Prof. W. Bjerknes' hydrodynamic theory.* In the analytical

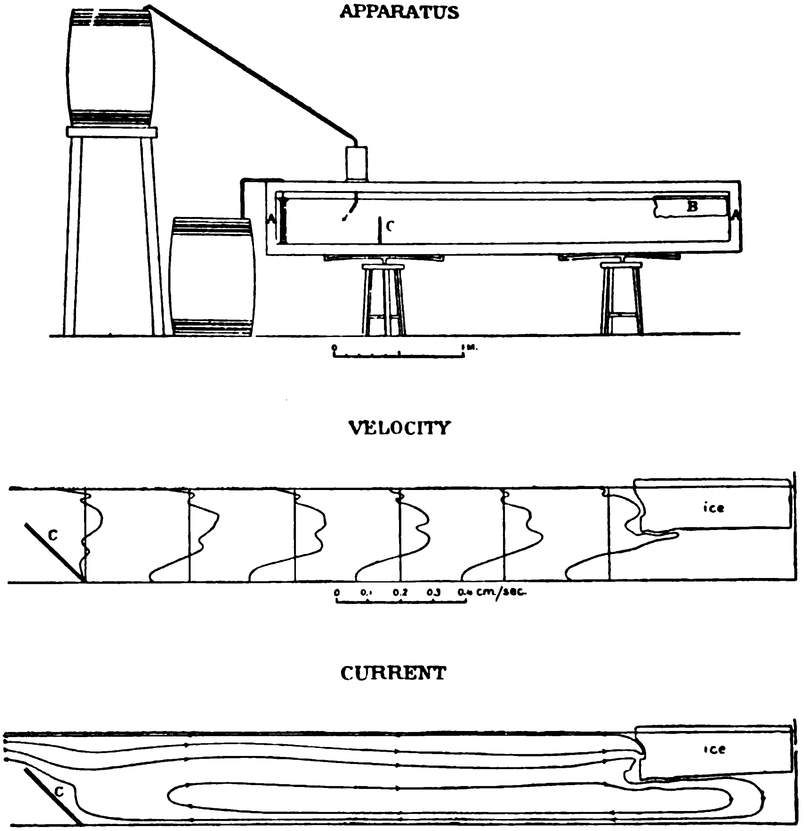

FIG. 10.—ICE-MELTING EXPERIMENT (KRISTIANIA).

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* V. Bjerknes, "Ueber einen hydrodynamischen Fundamentalsatz und seine Anwendung auf die Mechanik der Atmosphäre und des Weltmeeres," *K. S. Vet. Ak. Handl.*, Bd. 31., 1898.

work, Mr. Sandström was assisted by our chemical assistant, Miss A. Palmquist. The particulars of this experiment will be described in a separate paper. Mr. Sandström, who employed an extra current of less intensity than I had used, was able, on account of the larger scale on which he operated, to study the ice-melting phenomenon in the immediate proximity of the ice. He found that the accelerating forces generated by the melting of the ice are very intensive, and tend to establish the triple-current system which I have described. According to Bjerknes' theory, we can easily determine the magnitude of the accelerating forces in action within the tank (as well as within the ocean), by computing the number of c.g.s. solenoids formed by the intersection of the isobathic and isosteric lines of a section through the tank. Calculus shows that within the longitudinal section of the tank shown in the following figure there were two principal fields of forces—one under the ice accelerating in this direction Ↄ (= 0·57 c.g.s. solenoids), the other at the opposite side in the vicinity of the partition accelerating in the opposite direction, C (= 0·18 c.g.s. solenoids). The mechanical energy developed by the melting of ice in sea-water consequently tends to generate a current of water cooled by contact with the ice along the bottom of the tank to the partition.

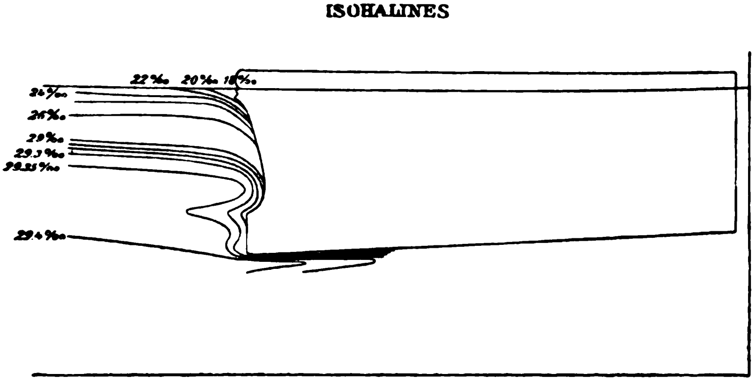

FIG. 11.—ISOHALINES IN THE VICINITY OF THE ICE.

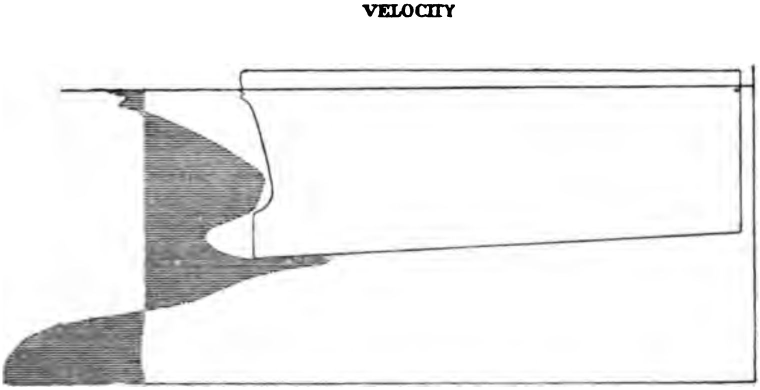

FIG. 12.—VELOCITIES MEASURED IN THE VICINITY OF THE ICE.

The maximum velocity of this current Sandström measured as 0·14 cm. to the second. The accumulation of bottom water at the partition counteracts the influence of the ice-melting process, the active force being, however, superior to the reactive by 0·39 c.g.s. solenoids. Consequently the bottom water must be carried out of the compartment in the shape of an under-current over the partition wall.* The other currents constituting the triple system were found to be well developed; the outgoing ("polar") current had a velocity of 0·03 cm., the ingoing ("Atlantic") current a velocity of 0·23 cm. to the second.

Mr. Sandström paid special attention to the distribution of temperature, salinity, and density in the immediate vicinity of the ice, as well as to the corrosion of the ice-block, which originally weighed 50 kilos. The following figures show the shape of the ice-block after twenty-four hours. The upper figure represents the isotherms of the water in contact with the ice. The lower figure is a diagram of currents. It will be seen that the action of the warm under-current is concentrated upon the under-surface of the ice-block. For further particulars I must refer to Mr. Sandström's own paper, which will soon appear in the reports of the Swedish Hydrographic Biological Commission.

I next tried to collect a material of hydrographic observations from the Norwegian sea which could be used for a comparative study of the influence of the ice-melting upon the circulation of that part of the ocean. I deemed only such series of observations to be worthy of attention *which were made after modern exact methods in the same year and in the same season of that year.* To combine indiscriminately recent and old deep soundings from many different years into one section, would, on account of the utterly changeable and instable hydrographic state of the Norwegian sea, on which I shall have to speak later, lead to mistakes.

The first year from which we have observations of the sort I wanted, made over a sufficiently large area of the Norwegian sea, is 1900. In that year Prof. Nansen and Dr. J. Hjort made their first cruise with the *Michael Sars.* In the same summer a Swedish expedition, under Mr. Kolthoff, visited the eastern part of Greenland. Dr. Oestergren, the biologist of Kolthoff's expedition, promised to make a couple of exact deep soundings in the ice-filled north-western part of the Norwegian sea. I likewise requested our former assistant in marine research, Captain S. Nilson, to make a couple of deep soundings in the southern part of the Norwegian sea on the slope of the North sea plateau. Nansen and I had then begun, with united efforts and with the technical aid of L. M. Ericson, in Stockholm, to perfect the construction of the Pettersson water-bottle. The first instruments of the new model were used that year on board the *Michael Sars* by Nansen, and on board the *Frithiof* by Dr. Oestergren. To Captain Nilson I left an excellent instrument of the old type, which he had used frequently during our previous cruises and on board his own fishing-vessel, the *Patterdale.* As all these ships were provided with the best instruments existing, and care was taken to ensure the greatest possible accuracy in observing and analyzing, the following longitudinal section will be of special interest combined, as it is from—

Oestergren's	deep	sounding,	July 8, 1900	...	77° 11′ lat. N., 0° 55′ long. W.
Nansen's	„	„	Aug. 11, 1900	...	69° 32′ lat. N., 5° 13′ long. E.
„	„	„	July 24, 1900	...	63° 50′ lat. N., 1° 20′ long. W.
Patterdale	„	„	„ 2, 1900	...	60° 40′ lat. N., 2° 43′ long. W.

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* The interesting question, What would happen if the wall was so high that the under-current could not pass over it? will be discussed later.

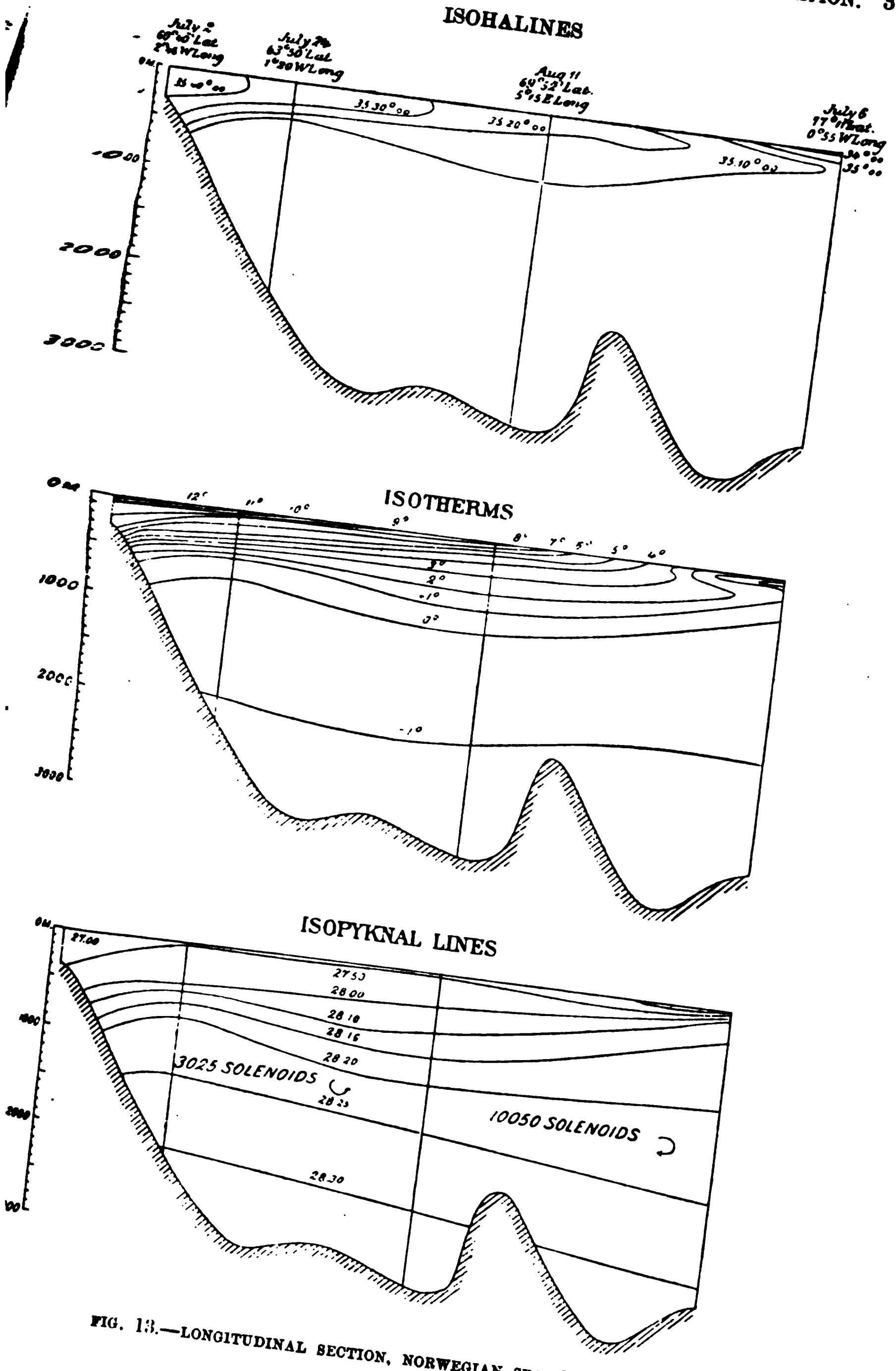

FIG. 13.—LONGITUDINAL SECTION, NORWEGIAN SEA, 1900.

This section bears a striking resemblance to the experiment (see p. 298). The trend of the isotherms indicates the existence of an under-current of warm Atlantic water from the central part of the Norwegian sea towards the ice off Greenland's east coast. At 200 metres under the ice Mr. Oestergren found the usual temperature maximum to be +1°·04. Above the region of maximal temperature there was the cold and diluted water of the polar current, t = −0°·03, salinity = 33–34 per cent. From 400 to 500 metres Oestergren found cold bottom water (temperature at the bottom = −1·°23), which is Atlantic water which has given up nearly all its disposable store of heat in order to maintain the ice-melting process, as will be shown by the diagrams, which represent (1) the isohalines, (2) the isotherms, (3) the isodenses of the sea-water from 77° lat. to the Shetland bank. The principal field of force is found in the vicinity of the ice, *i.e.* at the north-western side of the Norwegian sea, where a number of 10,500 c.g.s. solenoids are found to exist between 70° and 77° lat., accelerating the motion in this direction, ↻. Between 64° and 70° lat. 3025 c.g.s. solenoids are found, acting in the opposite direction, ↺. The accelerating force which maintains the oceanic circulation in this section thus is equal to 7025 c.g.s. solenoids[*] ↻, which force is sufficient to increase the velocity of the water by 14 cms. per second in one week, the influence of the friction and of the Earth's rotation not being taken into account.

This field of forces will tend to carry a current of cooled water along the bottom of the Norwegian sea to the Wyville Thomson bank and the northern slope of the North sea plateau. The surface water will also have a tendency to flow southwards, and, on account of its inferior density, to spread over the surface of the sea. The diagram shows that the principal field of force is immediately under the ice. We must, however, bear in mind that the above calculus of the existing forces, viz. 7025 c.g.s. solenoids ↻, only indicates that there is a tendency in the bottom water to flow southwards towards the suboceanic ridge which forms the limit of the Norwegian sea, but by no means can be considered to give a measure of the actual velocity and direction of the issuing current, which, beside the accelerating forces here mentioned, also depends upon other circumstances, as the influence of the Earth's rotation, the friction, etc. Nothing, except actual measurements with current-meters, can settle this question.

The outlines of the circulation in the main part of the Norwegian sea will be clearly understood from the previous discussion of the hydrographic section from 1900. See also the current chart.

The principal *vis movendi* of the circulation is the ice-melting process in the western and north-western parts of the sea. Here in the vicinity of the ice-masses of the polar current we find located the accelerating forces of the circulation which tend to send Arctic water in two different currents, one at the surface, the other at the bottom, to the east and south. The upper one of these currents, usually called "polar current," sends one branch southwards through Denmark strait along the coast of Greenland, where its ice-masses remain nearly intact so long as the current keeps close to the coast bank. West of Cape Farewell the ice becomes scattered by the influence of the warm under-current in the deep part of Davis strait. The second branch is the East Iceland polar current, which divides in two parts, one following the coast of Iceland, the other taking a south-easterly direction along the northern side of the Iceland-Färoe bank. Both parts are usually free from ice, at least in summer, on account of the under-current of warm water in the deep channel between Iceland and Jan Mayen. But there are great exceptions to this rule in different years.

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[*] See Sandström's paper, "An Experiment on the Melting of Ice in Salt Water," *Reports of British Association*, Section E. Southport, 1903.

In certain years—known as ice years in Iceland—that island is surrounded by drifting ice-masses even in summer. The last year when this took place to an unusual extent was 1902. Mr. H. N. Dickson * mentions that in 1902 a block of ice was found drifting in the sea so far to the south as south of the Hebrides, near the Trishinish islands. It must have belonged to the East Iceland polar current. There seems to be no other explanation of such phenomena than to admit the possibility of great variations from one year to another in the inflow of Atlantic water into the Norwegian sea and in the development of the under-currents of warm water in that sea. That such variations take place in the Atlantic surface water I have demonstrated in a previous paper.

The third branch of the polar current is found to the north-west of Jan Mayen. Its course is marked by a great tongue or wedge of pack-ice in the ice-charts, protruding from the north-east part of Greenland (see the ice-chart for May and July on p. 288). From recent deep soundings made in this region of the sea by Ryder in 1891–92, and by Captain R. Amundsen in 1901, we infer that there is no under-current of Atlantic water to be found *under* the ice-filled area of this branch, but on either side of that area we find great bights or indentations in the ice-charts, which are caused by warm under-currents, one flowing to north-west north of Jan Mayen, the other flowing northwards west of Spitzbergen. The diluted Arctic surface water, which is produced by the melting of this ice, spreads widely over the surface of the Norwegian sea, especially in winter, when the greater part of the Norwegian sea is covered with diluted ice-cold water.† Thereby the area of warm Atlantic water in this sea is considerably diminished during the colder season of the year. The chief cause of this phenomenon is that the Atlantic water becomes denser than the Arctic surface water when cooled beyond +4° C. The inundation of the Atlantic water by Arctic water from the west may even go so far that the warm area of the Norwegian sea is divided in two, as I have shown was the case in March, 1898, from the observations of two whalers.‡ The "weak point" of the Atlantic current in winter seems to be situated about 65° N. lat.

The comparatively thin sheets of Arctic surface water contained in the named branches of the polar current are, however, insignificant if compared with the great masses of water which sink to the bottom after having given up its heat to the ice, there to form an under-current which banks up against the eastern and southern limits of the Norwegian sea, filling its deep recesses with a layer of cold Arctic bottom water—the coldest which is known to exist in any part of the oceans of the globe, its temperature being about −1° C. in the southern and −1°·3 C. in the northern part of the Norwegian sea. The deep trough of this sea is brimful of such water up to the niveau of the submarine banks between Iceland, the Färoes, and the Shetland islands. The incessant supply of such cold bottom water generated by the ice-melting in the western and north-western parts of the Norwegian sea causes an outflow in the shape of under-currents to take place—

1. Over the Färoe-Iceland bank. See the diagram on p. 304.§

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* H. N. Dixon, "The Hydrography of the Færoe-Shetland Channel," *Geographical Journal*, April, 1903, p. 13.

† See *Pet. Mitt.*, *l.c.*

‡ This statement, which at first was advanced only as a theoretical consequence of the ice-melting theory, was in the beginning much contested. Dr. H. Gran, however, from observations collected by Dr. J. Hjort in 1897 and 1898, has found that "the Arctic water in March, 1898, and possibly in 1897, reached so far that it overflowed the Gulf Stream for a short distance in about 65° lat. N."

§ Thor's section on Fig. 14 is an illustration of this fact. The diagram represents a section across the Färoe-Iceland bank (see the *Bulletin* for August, 1903, of the

2. Over the Wyville Thomson bank.
3. Through the Norwegian channel into Shagerack and Kattegat.

The named supply of cold water causes an updrift of Arctic water over the northern slope of the North sea plateau, where it mixes with the warm Atlantic water which flows into the Norwegian sea between Scotland and the Färoes, and by the influence of the Earth's rotation is deflected eastwards.

These hydrographic conditions exercise the greatest influence upon the fish-life of the Norwegian sea and North sea. For what we know at present of this subject we are chiefly indebted to the researches of Dr. J. Hjort. The brilliant results obtained by Hjort during his cruises in 1900-1903 with the *Michael Sars* are not yet published in detail. From his preliminary reports,* we infer that the hydrographic limit between the cold bottom water and the upper layer of Atlantic water is also a biological limit between an Arctic and an Atlantic fauna of fishes. Below 600 metres the trawl brought up Arctic species of fishes; from that depth the coast banks abounded in the ordinary eatable fishes of our seas—cod, ling, halibut, herrings, and others. There can be no doubt that the bathymetric limit of this fish-life, found by Dr. Hjort, is determined by the level of the submarine

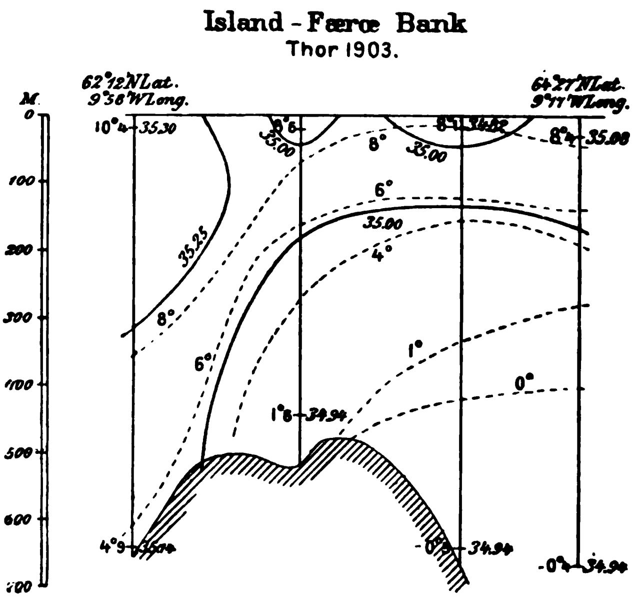

FIG. 14.

International Investigation of the Sea, Pl. iv.). On the right (northern) side of the bank we find the isohalines and isotherms of the Arctic bottom water of the Norwegian sea rising up to 200 metres from the surface. In another diagram on the same plate of the *Bulletin* is represented a section along the bank. At the deepest niveau north-west of the Färoes, the isohalines and isotherms of the outflowing Arctic under-current appear.

* J. Hjort, "Die erste Nordmeerfahrt des Norwegischen Fischerdampfers *Michael Sars* im Jahre, 1900," *Pet. Mitt.*, 1901, iv. pp. 73-83. *Vide* also Dr. Hjort's latest Reports to the Norwegian Government.

banks between Iceland and Scotland, which permits the Arctic water to escape into the Atlantic at about 500 to 600 metres' depth from the surface.

According to Hjort, this fish-life is not bound to the coast banks only. From the upper niveaus of the great body of Atlantic water in the Norwegian sea, the angle-lines and drift-nets of the *Michael Sars* brought up cod and herrings, and from the deeper layers of 400 to 600 metres, fishes such as Sebastes, and others.

Not less interesting are the results of the Norwegian cruises with regard to the distribution of plankton, of fish larvæ and eggs, of jellyfish, salpæ, etc., in the surface water. In July and August, 1900, the different areas of water of Atlantic and Arctic origin, as well as the littoral waters west of Norway, were as sharply defined in a biological as in a hydrographical sense. Special interest is attached to the broad area of littoral water of 34 per cent. up to 35 per cent. water west of the Norwegian coast. I consider this water to be formed in the same way as the waters of one part of the North sea, viz. by the updrift of Arctic bottom water, which banks up against the slope of the Norwegian coast bank as well as against the slope of the North sea plateau, and is mixed there with the waters of the fjords, the Baltic current, and Atlantic water. My reason for this supposition is chiefly the close resemblance of the plankton of the coastal waters of Norway with the ruling planktontype of the North sea (Cleves "Tripos-plankton"). Moreover, Hjort has pointed out that the fish fauna of the eastern, southern, and south-western coast-banks (Norway, Shetland, the Färoes to Iceland) has the same general character, although certain species may occur more abundantly in different localities (as, *e.g.*, cod at the northern coast banks of Norway, ling on the Shetland bank, halibut on the banks discovered by Hjort north of the Färoes, etc.).

THE TRIBUTARIES OF THE NORWEGIAN SEA.

Experiments upon ice-melting under a limited supply of warm sea-water—The hydrographical state of the ice-fjords of Greenland, of the north polar basin, of the Barentz sea, and of the North sea, the Skagerack, Kattegat, and the Baltic.

In order to demonstrate the hydrographic conditions of the Norwegian sea and North Atlantic, I am obliged again to refer to the experiment with the tank described on p. 295. In this experiment the ice-melting process was maintained at the cost of the heat stored up in the water of the under-current which penetrated into the inner compartment over the partition—the under-current derived from the extra current which circulated through the outer compartment. What would happen if the supply of warm water from that compartment was diminished or cut off altogether? We might realize this in our experiment in two different ways: either by making the partition higher, so that there was little or no space left for the under-current to pass over it between the outgoing surface current and the likewise outflowing cold bottom water, or by stopping the extra current. Such an experiment might serve to elucidate the hydrographic conditions of certain fjords of which the deep inner basin is more or less cut off from free communication with the sea by a submarine ridge at the outlet, or of very remote parts of the sea into which the Atlantic water enters sparely or in indirect ways.

The simplest experimental arrangement of this kind which I could imagine was to dispense altogether with the partition, and study the melting process of a large mass of ice (half a ton) placed in a big aquarium, shown in Fig. 15, containing 12 cubic metres of sea-water.

In the figure is represented the distribution of temperature in the water four hours after the ice had been introduced. The initial temperature of the water after careful stirring was 6°·38 C., the temperature of the air was 6°·1 C. Arrangements had been made for taking water samples and temperature observations at four "stations" from the surface to 120 cms. depth.

The displacement of the immersed part of the ice was 130 litres. After this quantity of water had left the aquarium, the effect of the ice-melting process began to appear in the shape of a continual outflow from the outlet. The outflowing water was measured and analyzed. The salinity of this water was, during the first four hours, found to be on the average nine-tenths of the original.

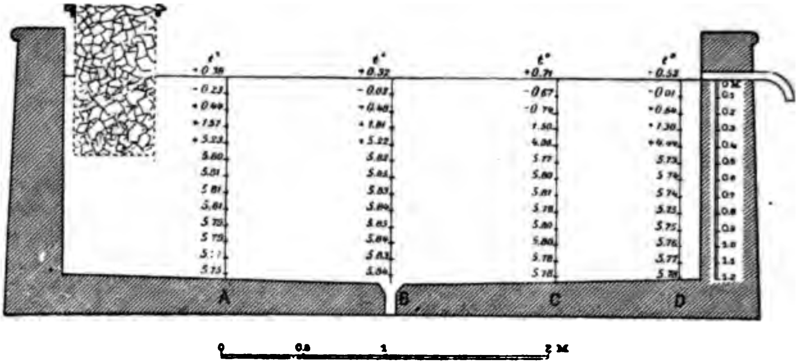

FIG. 15.—ICE-MELTING EXPERIMENT.

The quantity of the outflow diminished gradually in the same measure as the heat stored up in the upper layers was consumed by the ice. During the first four hours the debit from the outlet was 750 c.c. in the minute. After four hours it was 404 c.c., after three days 83 c.c., after five days 50 c.c. in the minute.

From the temperature series* taken at the four stations after the first four hours of the experiment, we can draw the important conclusion that the entire mass of water from the surface to the bottom takes part in the ice-melting process. There is, however, a great difference between the heat debit of the upper layer from the surface to 50 cms. depth, which is in niveau with the ice, and that of the bottom water under the level of the ice from 50 to 120 cms.

In the upper layer the temperature and salinity decreases rapidly. This decrease begins at the surface and proceeds downwards. After four hours the decrease of temperature in the different water-layers was as follows:—

From 0 to 10 cms.		Δt = 6°·30	ΔQ = 4,337,740 calories.
„ 10 „ 20 „		„ = 5°·83	„ = 4,014,130 „
„ 20 „ 30 „		„ = 4°·82	„ = 3,318,710 „
„ 30 „ 40 „		= 1°·39	„ = 957,050 „
„ 40 „ 50 „		„ = 0°·60	„ = 413,120 „
„ 50 „ 60 „	under the ice	„ = 0°·58	„ = 399,340 „
„ 60 „ 70 „		„ = 0°·58	„ = 399,340 „
„ 70 „ 80 „		„ = 0°·58	„ = 399,340 „
80 „ 90 „		„ = 0°·58	„ = 399,340 „
„ 90 „ 100 „		„ = 0°·58	„ = 399,340 „
„ 100 „ 110 „		„ = 0°·58	„ = 399,340 „
„ 110 „ 120 „		„ = 0°·60	„ = 413,120 „

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* Dr. F. Åkerblom, then Assistant to the Swedish Commission, kindly assisted me in making these rather troublesome observations.

The upper stratum from 0 to 50 cms. had thus contributed with 13,040,750 calories, and the undermost layer from 50 cms. to the bottom with 2,891,600 calories, to the ice-melting process. All in all, 15,932,350 calories had been given off from the water during the first four hours of the experiment. This agrees fairly well with the amount of latent heat which must have been absorbed by the ice in melting.*

The regularity with which the heat is given off, and the uniformity of temperature which prevails in the deeper water-layers under the niveau of the ice, are highly remarkable.

It seems probable that the circulation of the water-strata in niveau with the ice is kept up by means of horizontal currents of the usual kind that ice produces in sea-water, while the circulation in the water under the ice is effected by vertical convectional currents, *i.e.* by the sinking of water-particles cooled in contact with the cold water of the upper layer and the rising of warmer water from the bottom. I could not directly observe the movement of the waters in this experiment as in the others, because the walls were not transparent, but I think that the extremely regular debit of heat from the deeper strata can best be accounted for by the explanation here given. The determinations of salinity show that, while the salinity of the upper layer is very much reduced by the influence of ice-melting, the decrease in salinity of the bottom water is very little. After twenty-one hours the salinity at 20 cms. had sunk from 24·77 per cent. to 21·91 per cent.; at 60 cms. it was found to be 24·61 per cent.

The whole process thus tends to produce a layer of water of low temperature and salinity of the same depth as the ice, and another layer of very uniform temperature and salinity beneath it. The characteristic features of the ice-melting phenomenon under the conditions given, viz. unlimited supply of ice and limited supply of sea-water, are the following:—

1. The maximum of temperature and salinity which is found immediately under the cold upper layer in Arctic seas, where under-currents of warm water have free access, does not exist.

2. The slow, gradual decrease of temperature, which is found in the deepest layers of Arctic seas, does not exist.

3. The entire mass of water gives off heat to the ice, the upper layer rapidly, the lower indirectly and at a slower rate. Thus, ice floating on a layer of ice-cold fresh or brackish water will slowly melt at the cost of the heat stored up in an underlying stratum of warmer and salter sea-water.

These rules have a direct bearing upon the hydrographic conditions of the ice-fjords of Greenland, as will be seen from the following diagram (Fig. 16).

The figure represents a longitudinal hydrographic section of the great Arsuk fjord at 60° 42′ N. lat., 46° long. W. The interior basin of the fjord is about 600 metres deep, and is separated from the deep water of Davis strait by the coast bank, which probably is about 100 metres deep. At the inner end of the fjord, one of the great glaciers of Greenland dips its ice-masses in the salt water of the fjord to a depth of 100 to 200 metres. A. Hamberg† made an hydrographic investigation of this fjord in 1883, and found the situation as shown in the preceding diagram. There were two layers of water, the upper holding

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* The quantity of water which had left the exit tube during the said time was 193 litres, which is equivalent to 193 kilos ice, which absorbs 15,440,000 calories in melting.

† "Hydrografisk kemiska iakttagelser under den Svenska Expeditionen till Grönland, 1883," *Bih. S. V. Ak. Handl.*, Bd. 9, No. 16, pp. 44–49.

32 and 33 per cent. of salt, the undermost 34 per cent. The upper layer from 0 to about 200 metres was, with the exception of the surface water, which was heated by the sun up to 7° C., very cold (–0°·2 to –0°·6 C.). This is, of course, an effect of the ice of the glacier and the icebergs. From 200 to 600 metres the temperature is uniformly +1°·4 C. and +1°·3 C., at the bottom +1°·8 C. The state of the Arsuk fjord is a striking example of the hydrographic conditions I have tried to realize in the experiment just described. There has evidently taken place an inflow of warm and salt Atlantic water from the under-current of Davis strait over the coast bank into the Arsuk fjord at some previous occasion. That the inflow of such water is intermittent and not continual is proved by Hamberg's deep soundings on the coast bank outside the fjord, where he nowhere found water of higher salinity than 33·75 per cent., while the salinity of the bottom water inside the fjord was 34·11 per cent.

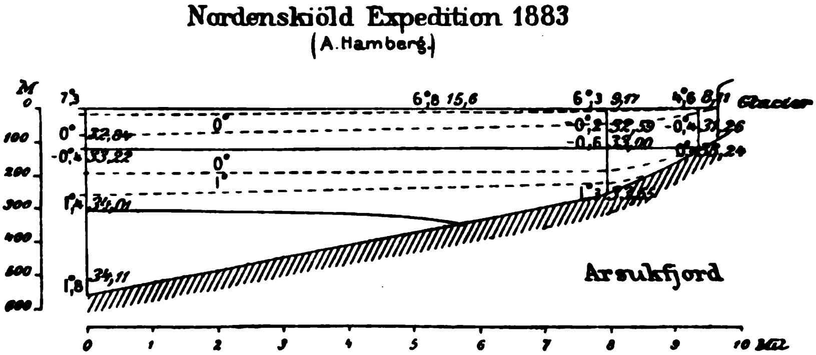

FIG. 16.

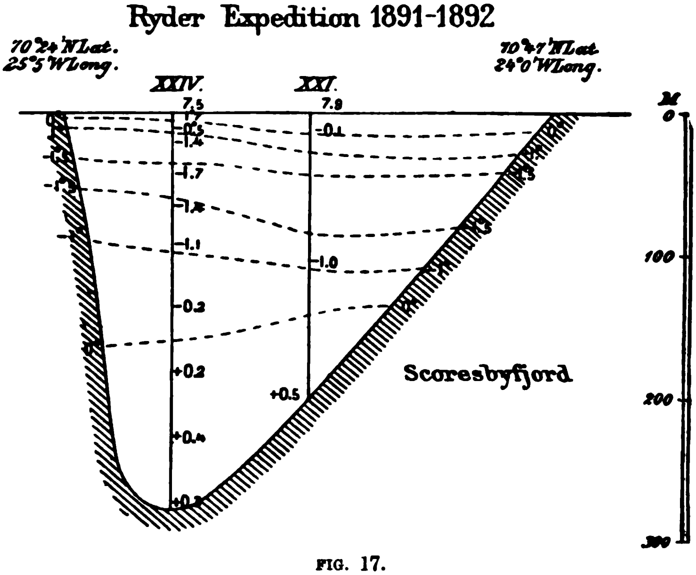

FIG. 17.

In Fig. 17 is represented a transversal section of another ice-fjord, the Scoresby fjord, on the east coast of Greenland at 70° 31′ N. lat., 25° long. W., made by C. Ryder* in 1891.

Scoresby fjord is an ice-fjord of the same hydrographical type as the Arsuk fjord. It receives its warm bottom water intermittently by an inflow from the warm under-current which Ryder discovered outside the coast bank of Greenland. The highest temperature in the interior of the fjord (+0°·5 C. at 45 metres' depth) is not much inferior to the maximum of temperature (+0°·6 C.) in Ryder's station xxvii. at 300 metres' depth outside the coast bank. But the entrance to the fjord is deeper, the debit of ice from the glaciers greater (Ryder mentions that great icebergs, 60 to 100 feet in height, emerge from the different branches of the fjord), and the supply of warm water more scanty than in the fjords at the western coast of Greenland. Consequently, we find the limit between the cold upper layer and the warmer bottom water beneath the level of the icebergs as deep as 150 metres from the surface.

From the deep soundings of Dr. F. Åkerblom, hydrographer to the Nathorst expedition to Greenland in 1901, we can form an idea of the hydrographic state of the Franz-Josef fjord on Greenland's east coast at 73° N. Lat.

FRANZ JOSEPH FJORD.

Station xiv.,† August 13, 1901. Lat. 73° 9′ N., long. 27° 15′ W.

Depth.	Temperature.	Salinity.	c.c. N_2 in 1 L.	c.c. O_2 in 1 L.	$\frac{100\ O_2}{N_2 + O_2}$
		‰	c.c.	c.c.	per cent.
0	+ 4°·28 C.	15·35	16·34	7·78	32·14
10	+ 0°·45	31·08	—	—	—
28	− 1°·37	32·52	—	—	—
60	− 1°·50	32·97	—	—	—
100	− 1°·53	33·62	—	—	—
150	− 1°·38	34·02	—	—	—
300	− 1°·33	34·07	16·14	6·93	30·05
450	− 0°·80	34·70	15·56	6·42	29·21
634	− 0°·45	—	—	—	—

The Franz Josef and King Oscar fjords abound in glaciers and magnificent icebergs. The melting of such ice-masses has nearly exhausted the amount of free heat stored up in the water ‡ unto a depth of more than 300 metres. Under that niveau there is a layer of water of higher salinity (34·7 per cent.) and higher temperature, which increases somewhat towards the bottom. This is a remainder of a former inflow of warmer water over the coast bank (the depth of which is unknown), which at the time of the deep sounding was shut off from communication with the ocean, as we may infer from the reduced amount of oxygen of this water, which at full saturation ought to have held 34·42 per cent., but holds not more than 29·21 per cent.

Wherefrom comes the inflow of warm water which at intervals enters into the deep of the Franz Joseph fjord? According to my opinion, it is furnished by an under-current of Atlantic water, which at about 72° lat. branches off from the main body of such water in the Norwegian sea, and north of Jan Mayen flows in a north-westerly direction towards the coast of Greenland. This theory has been much contested by Nansen[*] and Åkerblom,[†] who uphold the hypothesis first advanced by Ryder,[‡] viz. that the warm water which is found at the eastern coast bank of Greenland under the polar current derives from the warm under-current west of Spitzbergen, which between that island and Greenland divides in two branches, whereof one bends to the west and south, following the coast of Greenland.

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* "Meddelelser om Grönland," xvii., plate xi., 1895.

† 'Recherches Oceanographiques.' Par F. Åkerblom. Upsala Univ. Arsskrift, 1903, p. 28.

‡ The freezing-point of 34 per cent. is −1°·85 C.

It is evident that if an under-current of Atlantic water traverses a region of ice-cold polar water it can be traced by the maximum of temperature and salinity which appears in every deep sounding. The following results of such deep soundings in the sea between Jan Mayen and the eastern coast of Greenland seems to me to bear evidence concerning the existence of the warm under-current in question :—

	Östergren. July 26, 1900. 72° 10′ lat. N., 10° 57′ long. W.		Åkerblom. July 1, 1899. 74° 38′ lat. N., 15° 3′ long. W.	
Depth.	Temperature.	Salinity.	Temperature.	Salinity.
		per cent.		per cent.
0 M.	−0°·48 C.	31·12	−0°·95 C.	32·54
10–12 M.	−0°·05	31·00	−0°·65	32·81
20–25 M.	−1°·20	33·93	−1°·36	33·48
50 M.	−1°·43	34·52	−1°·53	34·27
100 M.	−0°·23	34·88	−1°·48	34·63
150 M.	—	—	−1°·00	34·70
200 M.	+0°·80	35·06	+0°·71	34·97
277–300 M.	+0°·55	35·05	+0°·70	34·99
500 M.	+0°·52	35·05	(Bottom, coast bank of Greenland.)	
700 M.	−0°·59	35·03		
(No bottom at 2000 metres.)				

Dr. Oestergren's deep sounding was made north-west of Jan Mayen, only 160 nautical miles from the first of Dr. Akerblom's soundings on the coast bank. It seems to me more natural to admit the probability of a direct connection between the warm under-current north-west of Jan Mayen and the warm water on Greenland's coast bank which was found *at the same depth,* 200 metres, than to accept the conjecture of Ryder—Nansen,[§] that this warm under-current has made the long circuit over Spitzbergen, the hypothetical ridge, and the coast of Greenland.

In Fig. 18 is represented a transversal section of the polar current between the 74° and 75° of latitude made by Dr. Åkerblom in 1900. Under this section is a diagram construed by Mr. Sandström, showing the number of c.g.s. solenoids which represent the accelerating forces arising from the differences of density in the water. We infer from the diagram that these forces tend to spread the ice and surface water of the polar current eastwards over the Norwegian sea, and to carry the warmer water below towards the coast bank of Greenland. The greatest number of solenoids is found under the ice 50 to 100 metres in depth.

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[*] F. Nansen, 'The Oceanography of the North Polar Basin,' Norwegian Polar Expedition, No. 9, p. 413.

[†] F. Åkerblom, 'Recherche Oceanographique,' *l.c.*, pp. 78-80.

[‡] 'Meddelelser om Grönland,' *l.c.*, p. 204.

[§] The observations cited in favour of this hypothesis by Nansen (p. 413 of his Memoir) bear out quite a contrary result. Oestergren, in his deep sounding at 77° lats. N., 0°·55 long. W., has hit the western part of the under-current which enters the polar basin. Amundsen's deep soundings show that there is a region between Greenland and about 4° long. W. where there is no warm under-current under the ice. This region is, as will be shown afterwards, occupied by the outflowing waters of the polar basin.

Mr. Åkerblom calculates the acceleration at 250 metres to be 0·0003 cm.-sec. between st. vi. and vii., and 0·00097 between st. vii. and ix. He comes to the

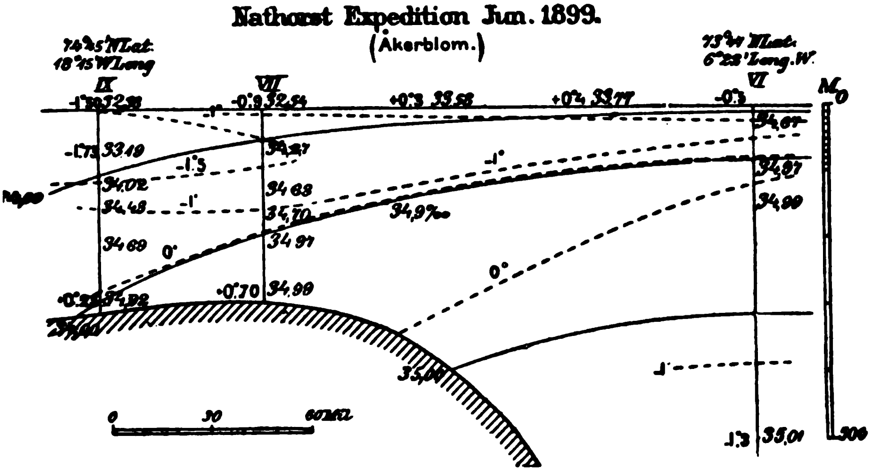

FIG. 18.

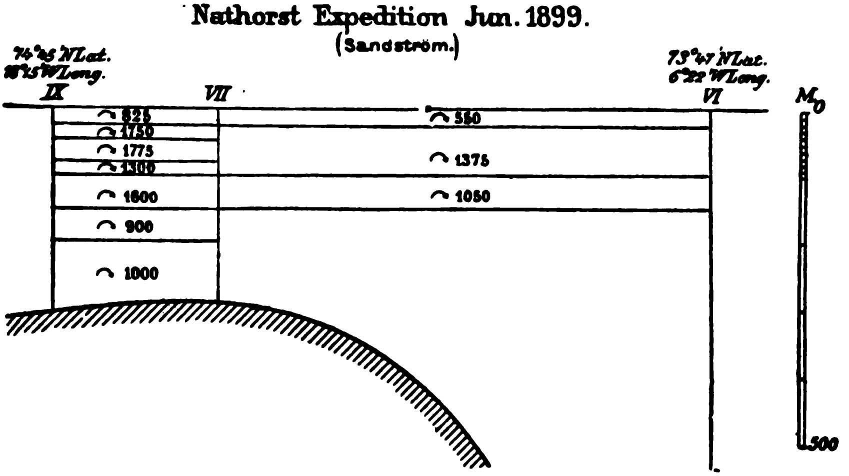

FIG. 19.

result that this force is counterbalanced by the increase of level and pressure arising from the influence of the Earth's rotation upon the south-going polar current.

In every calculus of this kind it must be remembered that, so long as we cannot take the influence of the friction of the bottom water into account, we must leave the question of the actual movement of the water open, until we, by direct measurements, can ascertain if the warm water upon Greenland's coast bank follows with the polar current, or adheres to the bottom and is carried northwards in the opposite direction to the surface current as a "reaction current" of the same kind that Ekman discovered in the estuary of Göta Elf.

In neither case can I believe that this warm water has made the circuit over Spitzbergen, etc.; and my chief reason is, that between north-eastern Greenland and Spitzbergen there is a region where—as will be shown later—there exists no warm water at any depth, the region, namely, where the outflow from the western part of the polar basin takes place.

Further proofs of the existence of a warm under-current flowing towards Greenland in these latitudes I find in—

1. The high percentage of oxygen = 32·94 per cent. found by Dr. Åkerblom in the water samples from the bottom of the Greenland coast bank at 277 metres. If this water had belonged to an under-current which had made the grand circuit along Spitzbergen, etc., the oxygen held in solution by the water ought to have been far more reduced.

2. The high percentage of lime in the bottom deposits of the deep sea northwest of Jan Mayen (see the chart on p. 293).

The most probable explanation I can give is, that the outflow of the cold waters from the polar basin takes place chiefly along the north-eastern coast of Greenland. In this region the temperature is −1° or below −1° C. in all depths. This region is marked by a great tongue of ice in the ice-charts. On either side of this area we find great indentations in the ice-charts known as the "north bight" and the "whalers' bight" from Scoresby's time. From the great body of Atlantic water in the centre of the Norwegian sea, two branches in the shape of warm under-currents on each side of the Arctic area (currents of compensation) are detached, one towards the east coast of Greenland north of Jan Mayen, the other towards the interior of the polar basin along the coast of Spitsbergen. See the current chart, Fig. 20.

Thanks to the assiduous efforts of the Russian Scientific Commission for the investigation of the Murman coast and the Barentz sea, under the leadership of Knipowitsch and later of Breitfuss in Alexandrowsk, the hydrographic features of that sea now begin to be clearly defined. It can be said without exaggeration that the current system of this distant part of the Atlantic ocean is at present as well known as that of the North sea—and in some respects even better.

Over the submarine bank between Norway and Spitsbergen the Atlantic current from the Norwegian sea enters the Barentz sea, following the direction of the deepest channels of the bottom. Knipowitsch distinguishes five different branches, one north and four south of Beeren island, which begin to separate from each other at about 30° long. E. The last observations from this region are published in the Bulletin of the International Exploration of the Sea, and in the last report of the Russian Commission edited by Dr. Breitfuss. In June, 1902, he found the temperature of the Atlantic water to be up to +3°·6 C.; the salinity nowhere exceeded 35 per cent.

At the surface this Atlantic water soon dips under the cold diluted water and the ice of the polar current which traverses the Barentz sea from north-east to the west. At the bottom it encounters another kind of arctic water of higher salinity than its own, 35·01 to 35·07 per cent., and of extremely low temperature, −1°·6 or 1°·7 C.

The origin of this cold water has been a great puzzle to hydrographers. Knipowitsch was the first who discovered a layer of cold and salt water at 150 to 200 metres' depth south-west of Novaya Zemlya. Nansen declared this water to belong to an under-current from the Kara sea through the Kara strait, which he denominated "the Lütke current." He supposes it to run northwards, following the western coast bank of Novaya Zemlya.

The recent Russian deep soundings published by Dr. Breitfuss leave no doubt about the origin of this water. In 1902 the Russian expeditions with the Andrej Perwosvanny and the Pachtussov found the characteristic high salinity and low temperature in the bottom water not only near Novaya Zemlya, but in the whole deep eastern trough of Barentz sea, according to the following extract from their deep soundings*:—

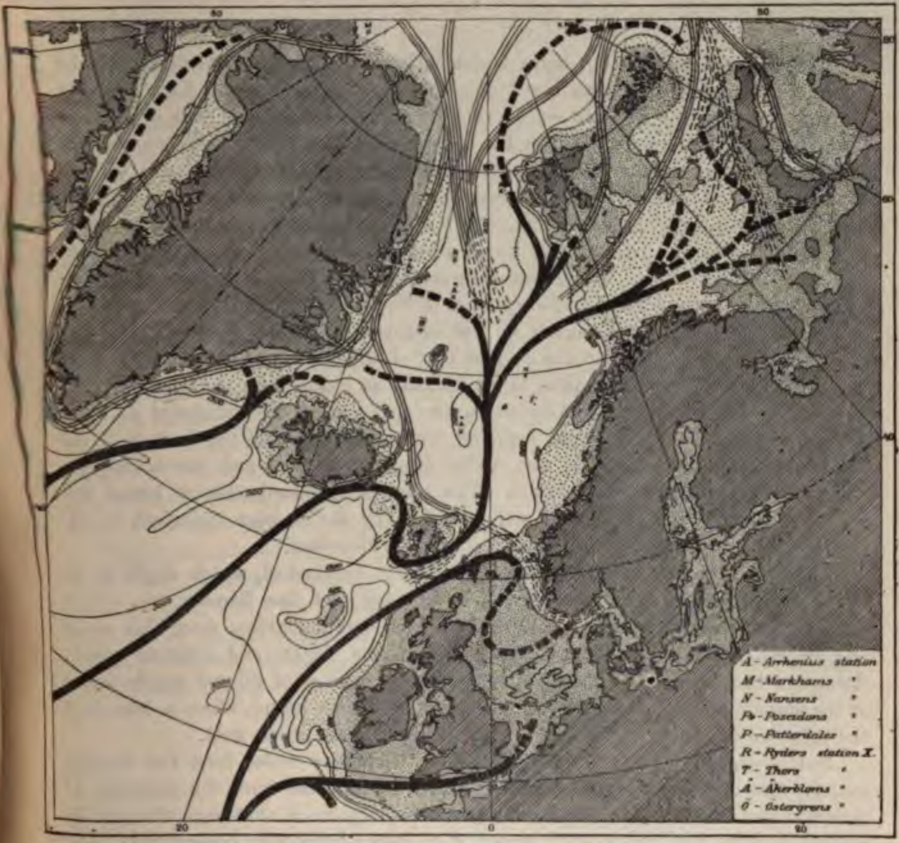

FIG. 20.—CURRENT CHART (FOR EXPLANATIONS SEE P. 289).

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* To these examples from 1902 we can add a deep sounding made by A. Wollebæk on board the *Heimdal* in 1900, in 71° 48′ lat. and 49° 38′ long. E., who found in 120 metres a salinity of 35·20 per cent., and a temperature of −1°·8 C. If the salinity is reduced to the common standard now in use, the result will be in accordance with the Russian.

Lat. N.	Long. E.	Depth (bottom).	Temperature.	Salinity.
		metres.		per cent.
73° 14′	50° 18′	260	− 1°·46 C.	35·01
74° 29′	54° 28′	150	− 1°·70	35·07
75° 35′	56° 16′	150	− 1°·70	35·05
75° 34′	45° 28′	310	− 1°·25	35·07
75° 27′	43° 45′	310	− 1°·38	35·05

This cold and salt bottom layer is evidently an updrift from the depths of the polar sea, which enters from north and north-east both into the Kara and the Barentz sea. In the Barentz sea it principally follows the coast bank of Novaya Zemlya, and therefore spreads over the deepest part of the bottom to the west in the same manner as the Atlantic water entering from the opposite side spreads eastwards. From the Kara sea a stream of cold water is known to enter into the Barentz sea through the Kara strait, which *may* consist of such Arctic deep water ("Lütke current"). In this cold water a very characteristic fauna, chiefly consisting of *Yoldia arctica*, which attains unusually great dimensions, lives. Knipowitsch* made this important discovery south of Novaya Zemlya, at 176 metres' depth, in the summer of 1901. Formerly he had discovered a similar Yoldia fauna north of the Petschora bay and in the deepest part of the White sea. Such cold areas with an exclusively Arctic bottom fauna indicate an inflow from the polar basin.†

On the other hand, the Atlantic water will favour the existence of more southerly species where it reigns supreme, while those parts of the bottom of the Barentz sea where the Atlantic and Arctic deep waters meet and intermingle are characterized by a "boreal" fauna. The interesting distribution of boreal and Arctic food-fishes in the Barentz sea, described by the Russian biologists, is also entirely ruled by the hydrographic situation here described.

There is, however, one circumstance, hitherto overlooked, which ought to be taken into account in discussing the hydrography of the Barentz sea. It is evident that there must exist somewhere a considerable outflow from this sea of the waters arising from the intermixture of the Arctic and Atlantic water. Attention has hitherto only been directed to the outflow of diluted Arctic water at the surface which takes place on both sides of Beeren island, where a branch of the polar ice-current sends forth a tongue of water to the south-west.

But it seems probable that there must exist another outlet from the Barentz sea, for the mixed waters of higher salinity which arise from the mingling of Atlantic and Arctic water in the deep eastern region of that sea. It will be noticed that an outflow of such water, if it exists (which at present is a mere suggestion), must first take the shape of an under-current, and biologically be characterized by such species as are known as "boreal" animals and plants. I remember that Dr. Hjort once called my attention to the possibility of the existence of a south-going under-current at the Norwegian coast. Such a current can scarcely be identified otherwise than by direct current measurements at all depths along the Norwegian coast bank, the hydrography of which still presents more than one intricate problem to solve. The interest attached to this special question is chiefly of biological nature. In the Scandinavian fjords and in the Baltic there exist several "Arctic" species of animals which are regarded by zoologists, after the example of S. Lovén, as *relicts* from the glacial period.

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* "Zur Kentniss der Geologischen Klimate," *Journ. Imp. Russ. Mineralogical Soc.*, Bd. & L., xi. p. 287.

† Well to observe, not a *continual* inflow.

Knipowitsch has declared the Yoldia fauna of the deep part of the White sea to be "relict."[*] The deep-water prawn, *Pandalus borealis*, which a few years ago was known to occur only in the interior secluded basins of some of our deepest fjords, the Drammen-fjord in Norway or the Gullmar-fjord in Sweden, was long considered to be such a relict form. Now, by the researches of Hjort, Wollebæk, and others, it has been proved that this species, which abounds in the Barentz sea, is an inhabitant of almost every deep fjord of the Scandinavian coast from Bohuslän up to Tromsö. The "relict" hypothesis can scarcely be upheld longer with regard to this species, and modern hydrography must look upon many of the doctrines of the relict theory with distrust, considering that another and more probable explanation may be expected from a closer study of oceanic circulation.

The greatest conquest of marine geography of later years is Nansen's discovery of the existence of a deep oceanic basin in the north polar region of the Eurasian continent. In spite of an insufficient equipment and adversities with the sounding-gear, etc., which were, however, remedied with admirable pluck, the *Fram* brought home from her celebrated drift across the north polar sea a large number of observations, which enable us to form an idea of the oceanic circulation of that sea, which Nansen describes as a large fjord or a 3000 to 4000 metres deep trough separated from the Norwegian sea by a shallow submarine ridge extending between the northern parts of Spitzbergen and Greenland. He supposes that this bank is lower (about 800 to 900 metres) in its eastern part, and higher (up to about 280 metres) near the Greenland coast. The Polar sea thus should be separated from the Norwegian sea by a submarine bank, in the same way as the Norwegian sea is separated from the North Atlantic by the Færoe-Iceland and Wyville Thomson banks. Nansen bases this hypothesis upon the result of his determinations of the temperature and the salinity of the deep water of the polar basin, which were both found higher than in the Norwegian sea at corresponding depths.

The question is of such importance that it becomes necessary to discuss the validity of Nansen's arguments. For such purpose we must first refer the salinities determined by Nansen to the modern standard now in use (Knudsen's tables). In Nansen's Memoir[†] the standard of salinity is 0·15 or 0·16 per cent. higher,[‡] according to Nansen's own estimate. After this reduction the bottom water should have the following salinity and temperature :—

In the Norwegian sea = 34·94 per cent.
„ polar basin = 35·14 „

Regarding the polar basin, we have, of course, no direct determinations to compare with Nansen's, but we have sufficient data from which we *a fortiori* can form an idea about the maximal value which in all probability can be ascribed to the salinity of the deep water of that sea.

The salinity of the polar sea is maintained by the under-current of Atlantic water which passes northwards along the west coast of Spitzbergen. G. Ekman and I used the opportunity of Andrć's first expedition to Spitzbergen with the *Virgo* in 1896 to arrange a thorough investigation of this warm current, the most northerly outlayer of the so-called "Gulf Stream." We chartered the ship for some days for a trip westward from the balloon station. Prof. S. Arrhenius, who accompanied André, kindly overtook the leadership, and made six serial deep soundings.[*] At the fourth of these deep-sounding stations, at 79° N. lat. and 4° 45′ E. long., in 400 metres' depth, Arrhenius hit the core of the warm undercurrent with a temperature of +2°·46 C. and a salinity of 35·29 per cent. As there has never been found water of higher salinity at any depth, either by A. Hamberg in 1898 (maximal salinity = 35·19 per cent.), or by Oestergren in 1900, at these latitudes, we can regard 35·29 per cent. as the upper possible limit of salinity in the waters of the polar basin.

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[*] Knipowitsch, 'Zur Kenntniss d. Geologischen Geschichte der Fauna des Weissen und des Murman-Meeres.' Petersburg, 1900, p. 30.

[†] 'The Oceanography of the North Polar Basin,' Preface, p. v.

[‡] Nansen, on pp. 406 and 331, calculates the salinity of the bottom water of the polar sea from hydrometric determinations, etc., to be 35·29 per cent., and that of the Norwegian sea, if calculated in the same manner, to be 35·08 or 35·09 per cent.

On the other hand, we must infer from what has been said in the preceding concerning the cold and salt water found in the north-eastern parts of the Barentz sea, which I consider to be an updrift from the polar basin, that the under limit of maximal salinity of the waters of that basin cannot be put lower than that of the Lütke current, viz. 35·07 per cent. Having thus defined the limits of maximal salinity which after all probability can exist in the polar sea, it remains to see in how far these conclusions are corroborated by the actual observations of the *Fram* expedition. Before the *Fram* left the polar sea, the hydrographer in charge, Dr. Blessing, at Nansen's request, took a series of water-samples by means of an ingeniously devised water-bottle, the construction of which seems to exclude the possibility of errors from untightness of the instrument.[†] These water-samples are the more valuable, as they are the only authentic material for analytic determinations of salinity which was brought home from the polar sea with the *Fram*. The numerous other salinities given in Nansen's tables are computed from determinations made on board with hydrometers or with an electric method (Kohlrausch's "telephone method") recommended by H. Tornoe, which proved unsatisfactory, and was abandoned already in 1894.

Dr. Blessing's water-samples were carefully analyzed after the return. From the chlorine analyses and specific-gravity determinations on p. 214 of Nansen's 'Memoir,' I have calculated the salinities by means of Knudsen's tables. Dr. Knudsen has obliged me by controlling one of the numbers, viz. the salinity of the water from 850 metres' depth.

Fram.
November 30 and December 2, 1895.
85° 28′ 6″ N. lat., 58° 44′ W. long.

Depth.	Temperature.	Chlorine.	Salinity.
0 metres	−1°·8 C.	—	—
150 "	−1°·4	19·040 per cent.	34·40 per cent.
200 "	+0°·09	19·234 "	34·75 "
250 "	+0°·54	19·312 "	34·88 "
250 "	—	—	34·88 [‡] "
450 "	+0°·69	—	35·10 [‡] "
550 "	+0°·51	—	—
800 "	+0°·12	19·393 "	35·03 "
850 "	−0°·03	19·385 "	35·02 "
900 "	−0°·06	—	35·00 "
1900 "	−0°·71	—	—

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[*] *Bihang K. Vetenskaps Aks. Handl.*, Bd. 23, II. No. 4, pp. 31–33.

[†] See the description on p. 142 of Nansen's Memoir.

[‡] The salinities are calculated from the chlorine analyses in Nansen's table, reduction being made for the bromide according to the principles of Knudsen. Where the per mille of chlorine was not determined, the salinity has been calculated from the specific weights as determined by Tornoe and Heidenreich at 17°·5 C.

We infer from this that the Atlantic under-current 360 miles north of Arrhenius' station iv. (where the Atlantic water was at least 800 metres thick, with a maximum of salinity of 35·29 per cent.) was reduced to 600 metres with a maximal salinity of only 35·10 per cent.

We further infer that there is a very marked decrease of salinity with the depth from the maximum at 450 metres downwards, so far as reliable observations go, or to 900 metres. Thus the hydrographic conditions with regard to the salinity of the water of the polar basin are of the same type as those which we have found to exist in the adjacent parts of the Norwegian sea. This observation will probably also hold with regard to the temperature. The temperature of the deep water of the Norwegian sea Nansen assumes to be $-1^\circ\cdot4$ C. This assumption, which rests upon Mohn's deep soundings in 1878, who found still lower values $-1^\circ\cdot50$ and $-1^\circ\cdot60$ C., etc., is uncertain * on account of the instruments used.

The same observation holds with regard to Nansen's temperature determinations with the Negretti-Zambra instruments, No. 75,680, 75,682, and 75,684. This conviction has forced itself upon me in studying Nansen's scrupulously conscientious report of his efforts to find the true correction of these instruments on pp. 40–58 and 237–242 of his Memoir.

Take, for example, the temperature series of the sounding at 85° 28′ N. lat. and 58° 44′ W. Here the Negretti-Zambra instrument No. 75,680 was used at 1900 metres' depth. Dr. Blessing's † reading was $t^\circ = -0^\circ\cdot65$ C.

The instrument had been tested before the departure, and the zero correction,‡ found to be $0^\circ\cdot07$ C. Two months after his deep sounding at 85° lat. N. Dr. Blessing determined the zero correction § to be $-0^\circ\cdot40$ C. Nansen, however, from certain reasons, reduces this correction to $-0^\circ\cdot12$ C. ‖

After the return the instrument was again tested, with the result that the correction ¶ was *nil*. Nansen, in his redaction of the temperature tables, has used a "probable correction" ** of $-0^\circ\cdot06$ for all temperatures determined with the Negretti-Zambra, No. 75,680, in the years 1895 and 1896.

After all, there seems to me to be still an uncertainty regarding the temperature at 1900 metres in the most northerly station: whether it is $-1^\circ\cdot05$ C., or $-0^\circ\cdot77$ C., or $-0^\circ\cdot71$ C., or $-0^\circ\cdot65$ C.

If we compare the "corrected" values of deep-sea temperatures on pp. 108–132 of Nansen's Memoir, we find variations in the temperatures below 1500 metres from $-0^\circ\cdot65$ C. to $-1^\circ\cdot24$ C.

Under the impression of Nansen's preliminary communications regarding the warm and salt "Gulf Stream water," which according to his observations should fill the depth of the polar basin, which could not well be explained without the assumption of a comparatively shallow suboceanic ridge between Spitzbergen and Greenland, and further regarding the great influence of the effluvies from the Siberian rivers upon the formation of the upper water-strata of that basin, I tried to explain these singular conditions by the hypothesis that the ice of the polar basin was in large measure protected from the attack of the underlying warm water by the fresh water wherein it floats.*

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* We know with certainty only that the bottom temperature is somewhat below $-1^\circ\cdot2$ C.

† Nansen's Memoir, p. 131.

‡ Ibid., p. 58.

§ Ibid. I am of the opinion that this correction ought to have been applied according to the usual rules for scientific observation.

‖ Ibid., p. 238.

¶ Ibid., p. 42. Prof. Mohn characterizes the instrument as "excellent." It is this remark of Mohn which has induced me to choose this example for my discussion.

** Ibid., pp. 58 and 238.

After a careful study of the tables of observations in Nansen's Memoir, I find that the hydrographic state of the polar basin below 800 to 900 metres must be considered as a matter of uncertainty, and that Nansen's idea that this basin is a secluded fjord separated by a shallow † ridge from the Norwegian sea and filled with water of exceptionally high salinity and temperature is not borne out by the existing observations. If the hypothetical ridge exists, it is even so possible that the temperature and salinity are lower than in the adjacent part of the Norwegian sea as that they are higher.

If we limit the discussion to the upper water-layers, the thermic conditions of which are admirably studied by Nansen and his followers, we find the usual warm under-current of Arctic seas well developed from about 200 metres. Both above and below this Atlantic under-current there is colder water of less salinity. The upper cold-water layer shows a temperature minimum at about 60 to 80 metres of $-1^{\circ}\cdot 90$ C., which is the temperature of equilibrium of ice and Atlantic water of 35 per cent. salinity. Below the warm under-current the temperature sinks under zero, and the salinity decreases slowly—the usual effect of ice-melting upon the water which gives up its heat to the ice.

After its entrance into the polar basin it is deflected to the east by the Earth's rotation, and follows the shelf of the continental plateau.‡ According to an interesting communication, just published by Knipowitsch, § there is a bight in this continental plateau east of Franz Joseph's land, at about 65° long. E., discovered by Makaroff during his expeditions with the *Yermak*. There, in 450 metres' depth, Makaroff, by the relatively high temperature, recognized the Atlantic under-current of the polar sea first discovered by Nansen.

Nansen has shown that this under-current conserves a temperature of $+0^{\circ}\cdot 5$ C. so far as north of the Siberian islands. It shows a marked tendency to thin out towards the north, and we can easily conceive that the Atlantic water will vanish altogether as an intermediary layer somewhere in the eastern, northern, or western parts of the polar basin.

Nobody has ever sounded these remote parts of the ocean, the regions of the "palæocrystic ice." ‖ Nevertheless, we can form an idea of the hydrographic conditions there from the deep soundings of Ryder and of R. Amundsen in the ice-filled area between 73° and 75° lat. N. and 1° to 10° long. W., where the whole water-stratum under the ice to 2000 metres was found to possess a temperature below -1° C.

We have here the outlet from the polar basin. The channel between Spitzbergen and Greenland contains in its eastern part the inflowing under-current of Atlantic water, in its western part the outflow from the polar basin. Before the warm water has completed its circuit around the polar basin, it thins out in the same measure its store of heat is exhausted by the ice-melting process, and the products of that process, viz. the Arctic surface water and the Arctic deep water, unite and continue their course through the western parts of the polar sea until they escape along the western side of the channel between Spitzbergen and Greenland. Amundsen's and Ryder's deep soundings are representative of the state of the western part of the polar basin; Mohn's, Arrhenius', Oestergrens' soundings represent the conditions of the eastern part of that basin traversed by the *Fram*.

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* See O. Pettersson, *Ymer*, 1900, p. 188.

† Nansen's Memoir, *l.c.*

‡ See Nansen's description, *l.c.*, p. 334.

§ Knipowitsch, "Ueber die Hydrologischen Verhältnisse des Nordostlichen Theils des Europaischen Eismereeres," *Revue de Peche et de Pisciculture*, Nos. 2, 3, 1903.

‖ North of Grant's land, in 83° 20′ N. lat. and 63° 5′ long. W., Markham found from the surface to 55 metres a temperature of $-1^{\circ}\cdot 9$ C., and from 55 metres to the bottom (at 132 metres) $-1^{\circ}\cdot 8$ C.

Ryder, sta. x.,[*] July 11, 1891. 75° 37′ lat. N., 6° 40′ long. W.	Oestergren, sta. i.,[†] July 8, 1900. 77° 11′ lat. N., 0° 55 long. W.	Arrhenius, sta. iv.,[‡] Aug. 21, 1896. 79° lat. N., 4° 45′ long. E.
0 m., −0°·1 C.	0 m., +1°·40 C., 33·42 per cent.	0 m., +4°·88 C., 34·89 per cent.
20 −0°·9	20 +0°·45 33·95 „	20 +4°·92 34·89 „
60 −1°·4	50 −0°·03 34·88 „	40 +4°·25 34·89 „
100 −1°·0	100 +1°·04 35·06 „	60 +2°·57 35·03 „
200 −0°·7	200 +1°·02 35·08 „	100 +2°·48 35·10 „
400 −0°·9	300 +0°·33 35·05 „	200 +2°·63 35·15 „
600 −0°·9	500 −0°·32 35·03 „	400 +2°·46 35·29 „
1200 −1°·2	1000 −0°·87 35·03 „	850 — 35·10 „
2000 −1°·3	2000 −1°·05 35·03 „	(No bottom)
(No bottom)	3100 −1°·23 35·03 „	
	(No bottom)	

The upper part of the cold water and ice, on leaving the polar basin, forms the polar current along Greenland, the deeper layers of which, according to Nansen's diagram[§] of Amundsen's deep soundings seem to have a temperature near −1°·4 C. and a salinity about 35 per cent., sink to the bottom of the Norwegian sea in the same way as the Arctic deep water, which is formed by the attack of the Atlantic under-current upon the ice between Iceland and Jan Mayen.

On the chart on p. 313, which is drawn in order to orientate the reader with regard to the sections and stations referred to in the text, I have drawn the isobaths of 200, 600 metres, etc., after Mohn's, Nansen's, and Knipowitsch's charts, and after the deep soundings of the Nathorst expedition communicated to me by Mr. A. Hamberg. I have also represented schematically the system of currents and under-currents of Atlantic and Arctic water after the principles of the ice-melting theory.

Nansen entertains another opinion of these matters.[||] According to him, the waters of the polar basin do not play any significant direct part in the formation of the bottom water of the Norwegian sea. He says,[¶] "the origin of this water has puzzled me much, as it seemed impossible that it could originate directly from the polar basin. I considered it more probable that it might be formed by cooling on the surface somewhere in the northern regions of the Norwegian sea itself."

But the difficulty is to explain how water of so high salinity can come to the surface in the north-north-west part of this sea, which is covered with ice and water of low salinity (32 to 33 per cent.) all the year round. Nansen supposes that this surface water is removed in winter, so that the Atlantic water of 35 per cent. comes into contact with the atmosphere. He thinks that this can take place in the following way: "We have seen that by the cooling during the winter the surface layers of the Gulf Stream become heavier, and this produces an eastward motion of the surface strata overlying the bottom water in the above region. At the same time the polar current along the Greenland coast is somewhat increased during the winter, and thus the cold bottom water at Amundsen's stations may be pressed still nearer to the surface, where it is rapidly cooled down. When it is sufficiently cooled to sink, it is replaced from the sides by water that is in its turn cooled down, and so the process is repeated. The salinity of the surface water is also simultaneously increased by the formation of ice."

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[*] C. Ryder and K. Rördam, 'Hydrografiske Undersögelser i Meddelelser om Grönland,' xvii. p. 256. Köbenhavn, 1895.

[†] *Ymer*, iii. p. 325. 1900.

[‡] O. Pettersson and G. Ekman, *Bih. K. d. Vet. Ak. Handl.*, Bd. 23, ii. No. 4, p. 32.

[§] Nansen's Memoir, plate xxxi.   [||] Ibid., p. 146.   [¶] Ibid.

The coldest upper layer of the north polar region, which I consider to be produced by the attack of the warm water of the under-current upon the ice, is, according to Nansen, an inflow from other (unknown) parts of the sea. He says,[*] "It seems clear to me that this colder water (the water which has the minimum of temperature $-1^{\circ}\cdot6$ to $-1^{\circ}\cdot9$) must originate from other parts of the north polar basin where the water near the surface has a similar salinity." Also the cold bottom water of that sea, which I consider to be Atlantic water, which has given up its store of heat to the ice and sunk down, is, in Nansen's[†] opinion, an inflow from other (unknown) regions. He says, "We are obliged to assume that this colder water originates from some other part of the north polar basin where the overlying warmer water has been cooled down to this lower temperature," etc. These hypotheses need no commentary.

Lastly, I think something ought to be said about the much-debated question of the outflow from the Siberian rivers. Nordenskiöld founded his plan for the circumnavigation of Europe and Asia upon the probability that the streams of fresh water emerging from the mouths of the great Siberian rivers in summer would form an east-going coast stream of navigable water along the Siberian coast. The success which attended his attempt might, in some measure, bear evidence in favour of this conclusion, which can scarcely be erroneous, since it is necessary that river-water which leaves the deltas of the Lena, the Kolyma, and others, with a certain velocity in a northward direction must be deflected eastwards. From the hydrographic observations of the *Vega*,[‡] I have shown that the salinity was higher to the west and lower to the east of every river. At Cape Tjeljuschkin I found that there was a break in this current.

Nansen[§] denies the existence of an east-going current along the Siberian coast, because in the observations of the *Fram* the freshest water was found north of the rivers, and he thinks that the observations of the Vega expedition will bear out the same rule, if the geographical position of every river lately determined by Baron Toll were substituted in the track-chart of the *Vega* instead of those given by Nordenskiöld's cartographers.[‖]

We must make a certain allowance for errors in the log of ships sailing like the *Vega* and the *Fram* in continual mist over a sea without certain landmarks. The discrepancy which Nansen finds to exist between the results of the *Vega* and the *Fram* expeditions can easily be accounted for, and is in fact very interesting. The *Fram's* track is more northerly than that of the *Vega*. The east-going current is probably confined to the vicinity of the coast. At that distance from the coast where the *Fram* sailed, the direction of the outflow from the rivers can have been altered by the general trend to the north and north-west which characterizes the surface water of the polar basin.

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[*] Nansen's Memoir, p. 323.

[†] Ibid., p. 337.

[‡] O. Pettersson, 'Contributions to the Hydrography of the Siberian Sea.'

[§] Nansen's Memoir, p. 294.

[‖] Ibid., p. 294.

North of the Siberian islands and of the continental shelf, no trace can be discovered of the river-water. At Nansen's stations ix. and xi., the salinity is about 29 per cent., and increases northwards and westwards to 31 to 33 per cent. The ice of the polar sea consequently floats in sea-water of more than 30 per cent. salinity, which increases with the depth until 170 to 250 metres, where the under-current is found. This upper water-layer Nansen denominates "the true polar water," and declares it to be formed chiefly by the admixture with the sea-water of the volumes of fresh water from the Siberian rivers.* To this definition I also agree on three conditions.

(1) That with "sea-water" is understood the water of the Atlantic under-current, and not any hypothetical inflow from some unknown region of the polar basin.

(2) That the term "true polar water" is taken in its widest sense, or "water of the polar current," since the same kind of water is formed not only in the polar basin, but everywhere in the course of the polar current where Atlantic water encounters the polar ice, from the Siberian islands to Cape Farewell and the coast of Labrador.

(3) That it is understood that the fresh water from the Siberian rivers is converted into ice by freezing before its admixture with the Atlantic water. It is necessary to admit this, because the intermingling of two water-layers of different salinity in a deep sea is an extremely slow process. On the other hand, the melting of ice in salt water is a most effective agency in establishing a homogeneous mixture by means of the powerful convectional currents which the ice-melting calls forth in the underlying water. The following experiment will show this.

Two large glass cylinders were filled with sea-water of 34·77 per cent. salinity, and placed beside each other on a table in the cellar of the laboratory. Two kilos. of ice were introduced into one of the cylinders, and two kilos. of ice-cold fresh water into the other, with due precautions in order not to stir the water. Twenty-four hours afterwards samples of water were taken at the following depths and analyzed:—

Depth in cms.	Cylinder with 2 kilos. ice.	Cylinder with 2 kilos. water.
	per cent.	per cent.
0	10·58	0·20
1	11·70	0·41
3	13·30	1·01
5	19·39	9·88
7	30·78	28·22
9	34·59	34·46
11	34·70	34·77
17	idem.	idem
27	"	"
37	"	"
47	34·70	34·77

We infer from this, that the presence of ice in sea-water occasions a most effective admixture between the fresh and salt water from the surface down to the under niveau of the ice. This explains why we always find salt water in the vicinity of sea-ice in Arctic seas. Under that niveau, the melting of the ice causes a slow decrease in the salinity of all water-layers to the bottom (from 34·77 to 34·70 per cent. in our experiment). This is an effect of the convective currents caused by the ice, and is in complete accordance with the results of the ice-melting experiment previously described. The intermixture between the cold fresh surface water and the salt water is limited to a very thin layer, and exerts no influence upon the deep water.

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* Nansen's Memoir, p. 315.

The fresh water which every summer emerges from the estuaries of the Siberian rivers is converted into icefloes by the atmospheric cold during the following winter on the shallow plateau north of the coast. So long as the icefloes remain in shallow water they are protected from the attack of the warmer water. Next summer, when they are drifted northwards, they come to float over a 2000 to 4000 metres deep sea. Tidal currents crush and fold the floes into hummocks of ice-blocks piled up against and upon each other. The undermost of these blocks reach to a depth of more than 60 to 80 metres, as we can infer from the fact that the minimum of temperature $-1^{\circ}\cdot9$ C. was found at that depth by Nansen.*

The site of the minimum temperature in Arctic and Antarctic seas is always found somewhat above the depth to which the ice is immersed in the water.† In the Antarctic ocean, where there are icebergs drawing more than 500 metres of water, the minimum of temperature is found about that depth. In the Scoresby fjord, where Ryder observed magnificent icebergs of 30 metres' height, the minimum was found at 100 metres, in the Franz Joseph fjord from 60 to 100 metres. Between Iceland and Jan Mayen the minimum region is found at 40 metres, which indicates that the screwing of the icefloes reaches still deeper.‡ In the polar basin there are no icebergs, but hummocks, the height of which was found by Nansen to be 15 to 30 feet. The immersed part of these hummocks can be estimated to seven or eight times that of the visible part, or to 40 to 70 metres.

The ice-melting process is not ruled by the average depth § of the ice, but by the maximal depth to which the ice is immersed. The deepest parts of the icebergs, hummocks, or floes are attacked vigorously, the thin floes slowly.

The hydrographic state of the North sea, the Skagerack, and Kattegat is very complicated and variable. Both from the channel and from the region between Scotland, the Orkneys, and Shetlands Atlantic water enters into the North sea. North and east of Shetland Arctic deep water banks up in the manner described on p. 302 against the northern slope of the North sea plateau. At 62° to 63° lat. and 3° to 5° long. E., the Arctic deep water has access to the deep Norwegian channel, which it follows as an under-current into the Skagerack, where it is regularly found at intermediate depths (between 15 to 30 metres to 150 to 200 metres) over the deepest part of Skagerack. Under it we find from 200 metres to 650 metres Atlantic water, which has entered over the North sea plateau and over the western and south-western slope of the Norwegian channel. Above it we find in summer a thin layer of Baltic water (salinity up to 30 per cent.), in winter a somewhat thicker layer of Bank water (salinity 32 or 33 per cent.). The plankton of the Arctic water in the Skagerack is very characteristic. It consists of large crustaceans, many of which are known from the deep water of the Norwegian* sea (400 to 500 metres), and even from the polar basin.† The most important forms are—

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* Nansen's Memoir, p. 323.

† Nansen's section on plate xv. (see stations ix. and xi.) is very instructive in this respect.

‡ G. Amdrup, 'Meddelelser om Grönland,' xxvii. p. 139, estimates the height of this screwed ice to 25 to 30 feet.

§ This remark is a reply to a statement on p. 156 of Nansen's paper, 'Some Oceanographical Results of the Expedition with the *Michael Sars*, 1901.' Christiania, 1901.

Thysanoœssa neglecta.	*Metridia longa.*
Parathemisto oblivia.	*Conchœsia borealis.*
Calanus finmarchicus.	*C. elegans.*
Chiridius armatus.	*C. obtusata.*
Euchæta norvegica.	*Krohnia hamata.*
Heterorhabdus norvegicus.	*Calanus hyperboreus.*

The Atlantic water from the Channel spreads over the shallow southern North sea plateau south of the Dogger bank, where it, however, becomes much diluted by admixture with the coast water and effluvies from the great continental rivers.

Poseidon 1902 - 1903

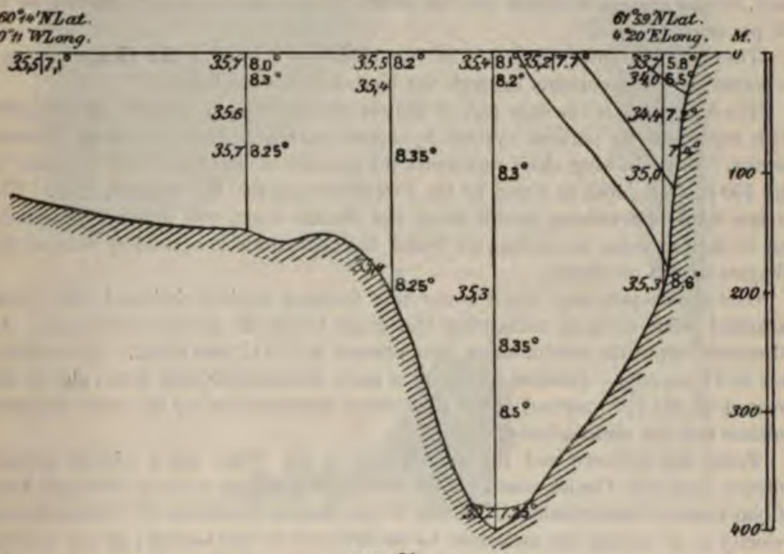

FIG. 21.

The Atlantic water from the Orkneys and Shetlands spreads, intermingled with Arctic water from the Norwegian sea, over the northern North sea plateau north of the Dogger bank, which plays the part of a kind of watershed in the circulation of the North sea, as was first distinctly proved by the excellent research in 1882-84 by the German gunboat *Drache*.‡ The Atlantic water from the southern North sea, as well as the Atlantic water from the regions north of the Dogger bank, enters the Skagerack along the coast bank of Jutland, and, on account of its greater density, fills the deep trough of the Norwegian channel and the Skagerack as already mentioned. The peculiar hydrographic conditions of the eastern North sea and Norwegian channel are shown in a section from Bergen to the Shetlands, made in January, 1902, by the German steamer *Poseidon.*[*] The water-layer of 33 to 34 per cent. salinity found in station iii. off the Norwegian coast between 0 metres and 70 metres' depth consists of the so-called "bank water," wherein the herring shoals are usually found in winter. The *Poseidon* arrived in the herring season, and partook in the fishery with drift-nets. We infer, from the description of Dr. Perlewitz, that the herring were exclusively caught in water of 33 to 34 per cent. a few miles from the coast. Further to the west, in the region of the Atlantic water, no herring were caught. The diagram shows clearly that the water-layers of 33 and 34 to 35 per cent. salinity and 5° to 6° C. temperature must have another origin than the salt inflow from the north-west, which was found on the little Fisher bank and in the depths of the Norwegian channel, where the temperature was found as high as up to 10°·2 C. In the plankton of the former were found forms such as *Limacina retroversa* and *Thalassiotrix longissima*, while the Atlantic water contained radiolarians, diatoms such as *Euodia cuneiformis* and other forms of more southerly origin. Between the Fisher bank and Heligoland, on the shallow southern plateau of the North sea, was found water of 34 to 35 per cent. as usual.

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* 'Svenska Hydrografiska Kommissionens Skrifter,' i. 3, p. 2.

† G. O. Sars, 'The Norwegian North Polar Expedition,' V. "Crustacea." 1900.

‡ 'Ergebnisse der Untersuchungsfahrten der Kubt. Drache in der Nordsee, 1882-84.

These waters enter through the funnel-shaped orifice of the Skagerack, and penetrate as under-currents through the Kattegat into the Baltic.

The Skagerack is the only part of the sea which has been hitherto investigated with regard to its current system by actual current measurements at different depths. The following chart represents the currents of the Skagerack between 20 and 100 metres' depth as found by the Swedish expedition[†] in August, 1901. The surface water everywhere, except along the Danish coast, was flowing westwards, but 20 metres under the surface we found the characteristic current system of the Skagerack well developed.

Over the deepest part Arctic water was found at stations Svii. and Sviii. over-saturated with oxygen, containing the great Copepods already mentioned. At 30 metres' depth the minimum of temperature +4°·9 C. was found. The salinity was 34·47 per cent. Isolated remnants of such Arctic water were found also in the greatest depths (200 metres) of the Kosterfjord characterized by the same plankton animals and the same salinity.

From the northern and the middle part of the North sea a mighty current entered along the Danish coast. This water contained an entirely different kind of plankton—*Tripos* plankton. North of the Skagen in station Sii. its maximum velocity at 40 metres was measured to be 59·9 cms. to the second; at the surface the velocity was not more than 28·9 cm.-sec. The inflowing waters from the North sea impinging upon the Swedish coast divided in two currents, one flowing northwards and westwards, another running southwards into the Kattegat. In the former current we measured the greatest velocity at 20 metres' depth in station Sx. = 70·7 cm.-sec. The velocity of the surface water in the same station was not more than 32·3 cm.-sec.

The under-current of water from the North sea conveyed a multitude of jellyfish, *Cyanea capillala* and *Aurelia aurita*, accompanied by small whitings of 44 to 87 mm. In the stomach of this breed we found the following plankton animals: *Temora longicornis*, *Calanus finmarchicus*, *Centropages typicus*, *Sagitta bipunctata*, which all belong to the Tripos plankton of the North sea. Breed of cod was not present. Dr. J. G. Petersen, earlier in the same summer, had also observed the absence of young cod. Dr. Petersen concludes that the breed of cod lives outside the Skagerack during the summer.

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[*] P. Perlewitz, 'Bericht über die Fahrt des *Poseidon*, December, 1902, and January, 1903;' 'Mittheil. des Deutschen Seefischerei-Vereins, Okt. 1903.'

[†] P. T. Cleve and O. Pettersson, 'Svenska Hydrografiska Kommissionens Skrifter,' i. *l.c.*, 3, p. 9.

In the southern part of the North sea another kind of water, the southern bank water, with its characteristic plankton (*Didymus* plankton), was found. With the inflow of this water, which commenced in the last days of August, began, as usual, the autumn herring-fishery in Kattegat. By the inflow of the southern bank water the under-current through the Kattegat, which had only 16·5 cm.-sec. velocity at 60 metres in station S_0, August 2, 1901, increased.

In winter and early in spring the Arctic water has its time of inflow into Skagerack, in the summer months the waters from the northern and middle North sea predominate, and in autumn comes the time of the inflow from the southern North sea of the southern bank water.

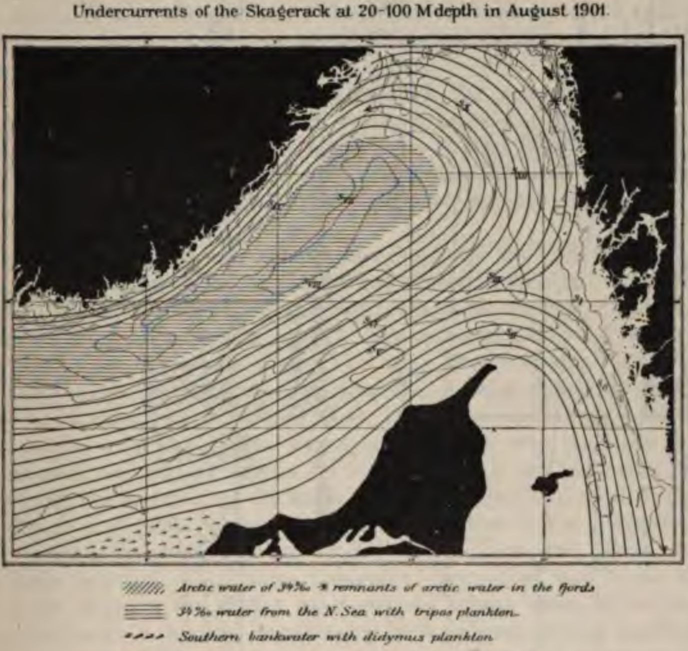
Undercurrents of the Skagerack at 20-100 M depth in August 1901.
Arctic water of 34‰ * remnants of arctic water in the fjords
34‰ water from the N. Sea with tripos plankton.
Southern bankwater with didymus plankton

FIG. 22.—CURRENT SYSTEM OF THE SKAGERACK.

This periodicity of the hydrographic conditions of the Skagerack is ruled by the great annual changes which take place in the ocean.* In autumn the flow of the Atlantic water towards the channel and the North sea and Norwegian sea increases in strength. On the following page are copied two hydrographic sections made by the hydrographer of the Nathorst expedition, Dr. F. Åkerblom, one in June, the other in September. At my proposal, Dr. Åkerblom made deep soundings at the same stations on the voyage to and from Greenland, and the commander of H.M.

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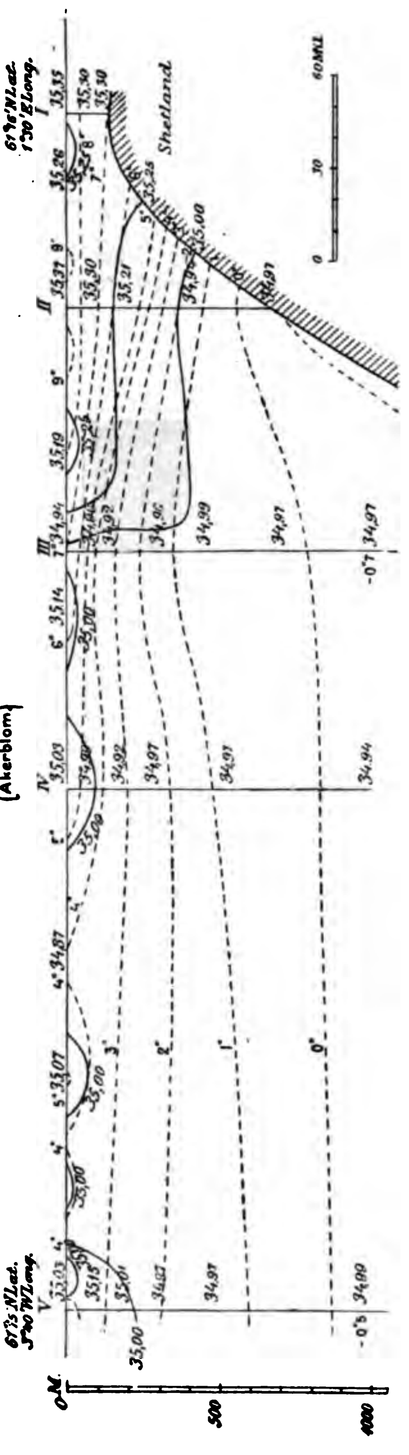
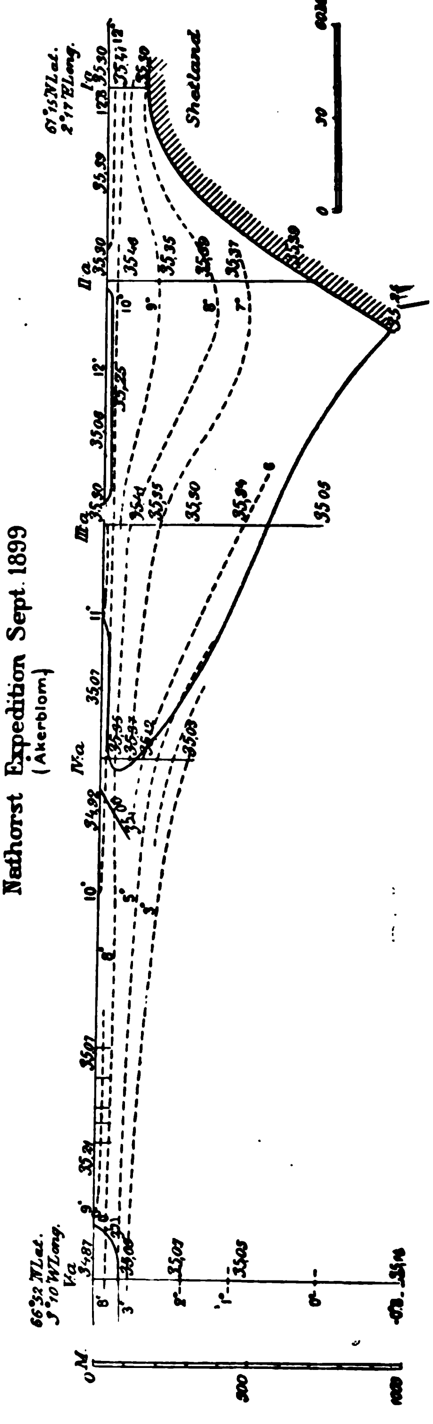
* See 'Les variations annuelles de l'eau de surface de l'ocean Atlantique,' par P. T. Cleve, G. Ekman, O. Pettersson (Gothenburg, 1901); and "The Circulation of the Surface Waters of the North Atlantic Ocean," by H. N. Dickson., *Phil. Trans.*, Sec. A. vol. 196 (1901).



Nathorst Expedition Jun. 1899
(Åkerblom)



Nathorst Expedition Sept. 1899
(Åkerblom)

Frigate *Freja*, Mr. Sidner, completed the series by a number of deep soundings in the North sea. The track of the ship is marked out in the chart.

The accumulation of warm and salt Atlantic water in the Norwegian sea north of the Shetlands from June to September, appears very conspicuously from the isohalines of 35 and 35·25 per cent.

The alternate inflow of Atlantic and Arctic water exerts a predominating influence upon the fish-life and the migrations of food-fishes, such as the herring, the cod, the mackerel, the hake, and others in our seas. As an example of the influence of the hydrographic conditions upon the fish-life of the Baltic, the result of our trawling experiments in the Baltic east and west of Bornholm, in October, 1901, may be mentioned. In both places the trawl brought up a relatively considerable number of plaice in spawning condition. The unusual season for spawning can be explained from the fact that the under-current from the Kattegat at this time of the year brings in a larger supply of warm and salt water into the recesses of the southern parts of the Baltic. We measured a velocity of 57 cms. to the second in this (in-going) under-current at 50 metres' depth in the deep channel between Bornholm and Skåne, on October 11, 1901.

Into this layer of warm and salt water which the under-current, during the last months of the year, accumulates in the deep recesses of the Baltic, the fishes take their refuge in winter when the upper water-stratum (the "Deckschicht") of this sea is cooled down to +1° or +2° C. from the surface to 30 to 40 metres' depth. In the summer months, July to September, we have always found these deeps of the Baltic empty of edible fishes.

The periodic inflow of water through the Sund and the Belt sea is felt in the Baltic at least so far as to the region east and west of Bornholm. Regarding the circulation in the interior part of the Baltic, the under-currents of the Bothnian sea, etc., I must refer to a former paper.* The under-current of the Kattegat and Baltic has not the character of a steadily flowing bottom stream. The outgoing and ingoing water-strata assume the shape of opposite cuneiform tongues or wedges, which appear sharply defined by the trend of the isohalines in the hydrographic sections. In case of equal atmospheric pressure over the Baltic and the North sea area, each current pursues its own way, but if the barometric pressure increases over the south part of the Baltic, the under-current in the Belt or Kattegat is stopped or even forced to run in a retrograde direction by the increased hydrostatic pressure at the southern end of the Kattegat, and *vice versâ*. From measurements made on board of lightships, Cronander † has proved that in the shallow parts of the Kattegat the surface water and the bottom water, in the plurality of occasions, move in the same direction, but with different velocity northwards or southwards. The oscillatory character of the movement over a shallow bottom plateau very much contributes to the admixture of the waters. The Baltic current increases in salinity from 10 to 30 per cent. during its course from the Sund to the point of Skagen.

In the Baltic, between Rügen and Skane, the salt water of the under-current flows along the German coast bank, as will be seen from the section on the following page.

Formerly it was believed that there existed a certain difference of level between the Baltic and the Skagerack, which acted as the *vis movendi* of the Baltic current.

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* O. Pettersson, "A Review of Swedish Hydrographic Investigations," *Scottish Geographical Magazine*, 1894, pp. 624–630.

† E. W. Cronander, 'On the Laws of Movement of Sea-currents and Rivers,' (Norrköping, 1898), p. 38.

This idea must now be abandoned, since a careful levelling has proved that the water-mark at Ystad (Baltic) is 0·024, and that of Landsort (Baltic) 0·023 metre below the mean annual level of the water at Varberg (Kattegat). The seasonal and annual variations of the water-stand of the Kattegat and the Baltic also follow each other closely.* Moreover, it has been proved † by Bjerknes and Sandström that the accelerating forces which arise from the differences of density in the waters of the Baltic proper are not sufficient to account for the movements of the upper and lower water-layers in the Belts and the Kattegat. Consequently we must infer that the influence of the ocean is the paramount power which governs the circulation of the Baltic. To the same conclusion we arrive also from the following considerations. The water of the Baltic is, with regard to its chemical components, diluted ocean water. The relation of the different saline components to each other is the same as in ocean water, or so nearly the same, that the salinity and density of a water-sample from the Bothnian gulf can be calculated from its amount of chlorine by the same formula as holds for the water of the Pacific, the Mediterranean, the polar basin, etc.

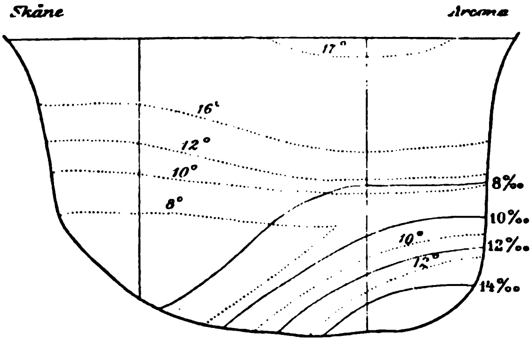

FIG. 24.—SKÅNE-RUGEN, AUG. 9–10, 1899.

From the preceding it will be understood that the oceanic circulation in the tributaries of the North Atlantic has a greater intensity and larger extension than hydrographers usually are prone to admit. The periodicity of this circulation is most conspicuous in the eastern parts of the North sea and in the Skagerack and Kattegat. The hydrographic situation here is a very complicated one, but as the waters of different origin are easy to discern from each other by their chemical and physical properties, and the leading plankton forms and the correspondency between the migrations of the fishes and the hydrographic seasonal changes become obvious to every observer who takes the trouble to repeat the same observations in the same place at different seasons of the year, it seems quite natural that the Scandinavian scientists, from the experience gained in their own seas, uphold the idea that the hydrographic state of a sea is the first and paramount ruler of its fish-life, and that fishery statistics can elucidate this matter *only if combined with a thorough study of the very changeable conditions under which the higher orders of marine animals live.*

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* P. G. Rosén, "Om Hafsytans Höjdförhållande vid Sveriges Kuster 1887–1900," *Svenska Hydrografiska Kommissionens Skrifter*, I. 5, 1901.

† V. Bjerknes and J. W. Sandström, 'Ueber die Darstellung des Hydrographischen Beobachtungsmateriales durch Schnitte' (Göteborg, 1901), pp. 3 and 4.

Concluding Remarks.

I have tried to show that the melting of the ice in the western and northern parts of the Norwegian sea exercises an influence upon the hydrographic conditions of all other parts of that sea. This influence must be of a periodic nature, since the melting of ice is so closely connected with the seasons of the year. Our ice-melting experiments show that that part of the water which descends is far greater than that which ascends and spreads over the surface. In my study of the ice-melting phenomenon in the sea between Iceland and Jan Mayen, I have calculated that part of the Atlantic under-current which mixes with the ice-water to be one-eighteenth, while the remaining seventeen-eighteenths become cooled from contact with the ice and sink to the bottom, there to form the great bottom layer of cold water of only $-1^\circ{\cdot}0$ to $-1^\circ{\cdot}4$ C., which is the lowest temperature existing in any ocean on the globe.* It is, in fact, not far from the limit $-1^\circ{\cdot}905$ C., which is the point of equilibrium between sea-water of 35 per cent. and ice. If in any year the hydrographic deep-soundings should indicate so low a temperature in the bottom-water, it would signify, either that the balance between the Atlantic water and the polar ice in the Norwegian sea was equal, or that the ice was in excess.

What this would signify with regard to the climate and meteorological conditions of Northern Europe can easily be imagined. The ice-filled area would rapidly extend from the western towards the eastern side of the Norwegian sea. Under the actual circumstances this encroachment of the polar ice-floes upon the warm-water area is checked by the inflow of Atlantic water, which must be in excess, since the bottom temperature is still at least $0^\circ{\cdot}5$ above the temperature of equilibrium, $-1^\circ{\cdot}9$ C.

If the supply of warm water is in excess of the ice, the cooled sea-water will mix with other water which has not been in contact with ice, and generate a bottom layer of higher temperature.

Such is the case in the Atlantic, Indian, and Pacific oceans, where the bottom temperature is above 0° (from $+1^\circ$ to $+3^\circ$ C.).

We infer from this that the hydrographic conditions of the Norwegian sea must be of a very labile character. In some years the ice predominates, as was the case in the summer of 1902, when Iceland in April was surrounded by polar icefloes, and the issuing current advanced so near to Europe that its cold waters were found in the midst of the Färoe-Shetland channel by the British International Expedition in August, and isolated blocks of polar ice were observed south of the Hebrides.

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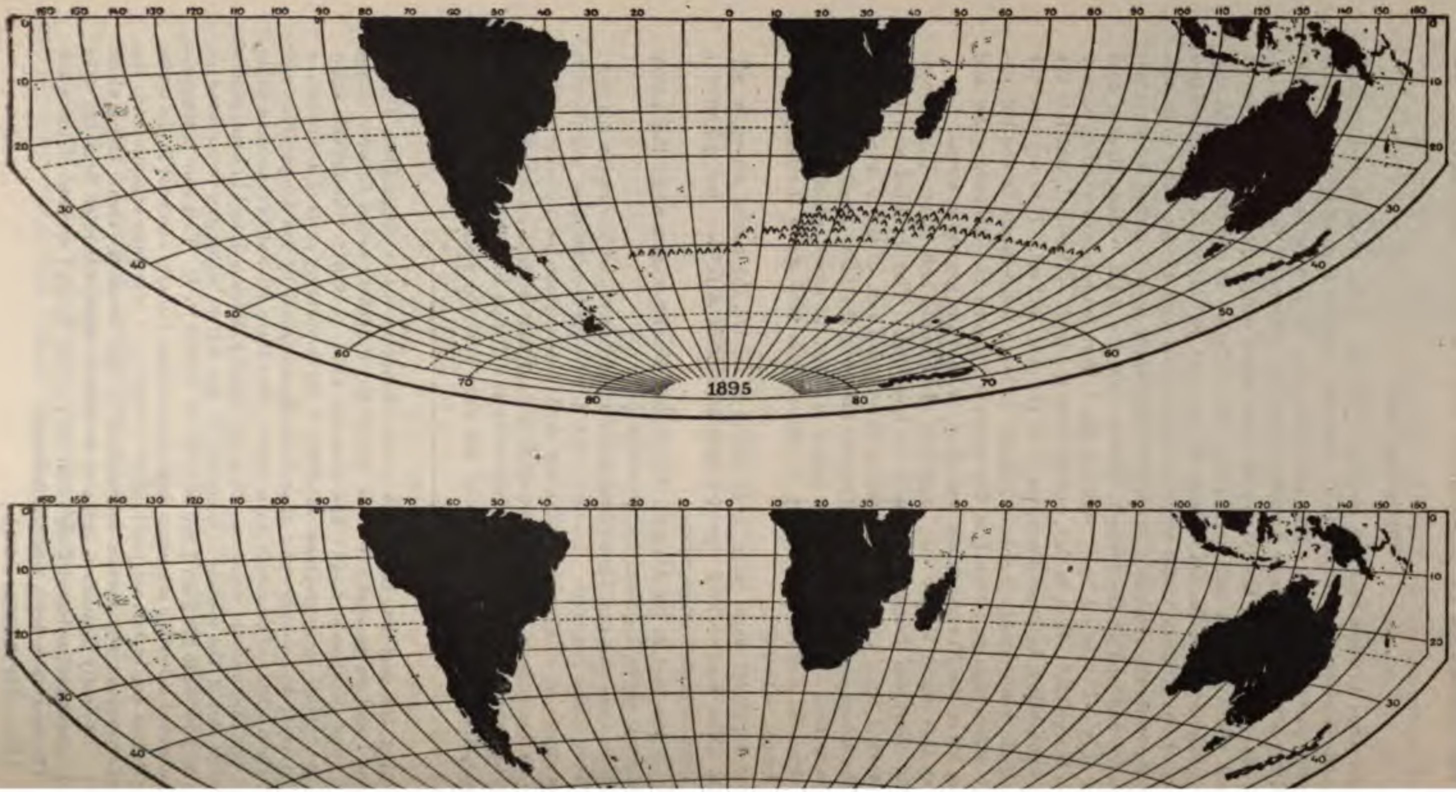
* During the last Swedish south polar expedition the hydrographer, Dr. G. Andersson, found an exception to this rule in the Bransfield sound between South Shetland and Graham's Land (this *Journal*, xxiii. p. 216): "Bransfield strait repeats the typical hydrographical condition of all ice-bearing parts of the ocean—a superficial layer and a deep-water mass, both characterized by low temperature, and between them a body of relatively warm water. But this section shows two remarkable features: the intermediate warm current is here faintly developed, and in consequence a very large part of the section is occupied by the bottom water, the temperature of which is only $29^\circ{\cdot}66$ to 29° Fahr.), the latter at the bottom itself. This bottom temperature is somewhat below the minimum deep temperature hitherto observed in the ocean (the Norwegian sea, bottom temperature $29^\circ{\cdot}3$ Fahr.), and it is quite exceptional in the south polar regions, the bottom temperature of the Antarctic ocean being about 31° Fahr. Evidently Bransfield strait is an isolated basin, separated from the open ocean by submarine shelves, which admit only a very limited renewal of the warm water. The maximum depth was 820 fathoms."

ICEBERGS IN THE SOUTHERN OCEAN.



There can be no doubt that the rough weather of that summer must be ascribed, for a great part, to this cause.

It is well known that all polar currents are extremely variable, not only from summer to winter, but also from one year to another. The grandest variations are found in the extent of the drift of the icebergs from the south polar continent. The influence of ice-melting is greatest in the south polar sea, because the icebergs here are greater than anywhere else. The energy set free by ice-melting is proportional to the depth of the submerged part of the ice. While 1 kilogram of ice belonging to an icefloe of the Greenland ice-current of 1 metre depth in melting produces an amount of work equal to 0·0139 kilogrammetres, another kilogram of ice from the undermost part of an iceberg which floats 500 metres deep gives birth to 7 kilogrammetres if melted in contact with one of the warm under-currents of the South Atlantic and the Indian ocean, which enter into the south polar sea following the deep channels east of Bouvet and west of the Kerguelen islands. It is a well-known fact that great "outbursts" of icebergs from the Antarctic sometimes take place, which shows that the state of equilibrium between ice and warm water is unstable also on the southern hemisphere. On the opposite page this outburst of ice from the south pole is represented by two charts, of which the material is borrowed from Mr. Russel's charts in 'Icebergs in the Southern Ocean.' Such outburst of south polar ice, whereby icebergs are drifted northwards to lower latitudes, will of course influence the state of the upper layers of the Atlantic, Indian, and Pacific oceans by reducing the surface temperature of the water. It is evident that the surface of the Indian ocean will be influenced most of all by the ice-melting in its southern part, and it remains to ascertain how far the cold water spreads northwards every year, and how far this cold water encroaches upon the warm area from which the water evaporates, which ultimately falls down as monsoon rain upon the adjacent coasts of India, Australia, etc. We must look out for the possibility that there exists a connection between the climatic variations of these countries and the outburst of ice from the south pole. It is a matter well worth noticing that the great droughts of India of later years fall in the last decennium of the former century, which was also the time of the last great outburst of ice from the Antarctic (1892–98).

The excellent meteorologists of the Indian Empire, M. Blanford and others, have long sought some device to forecast the droughts of India. At first they sought to found such forecasts upon observations of the snow cover of the Himalayan mountain ranges. Then they found it necessary to establish a grand net of observations upon the islands of the Indian ocean. If I might venture a suggestion, it would be this: to extend those observations all over the southern part of the Indian ocean, to institute regular surface observations on board of steamers, and to execute every year a number of deep soundings at certain stations from the equator to the deep channel west of Kerguelen.

The most prominent feature in the hydrography of the Indian ocean is the existence of a relatively thin superficial layer of very hot water superposed upon a large mass of cold water of Antarctic origin. By means of a large number of surface observations, combined with a small number of deep soundings executed at representative points, the extent of the warm area and the depth of the "Deckschicht" might be systematically investigated every year with the purpose of ascertaining the annual variation of its heat capacity. When the relations between the hydrographic and meteorologic phenomena are better acknowledged, the urgent necessity of substituting a systematic investigation of the sea instead of the occasional cruises of reconnoitring expeditions now in use will be understood.

With regard to the relation between hydrographical and meteorological phenomena, I must refer to a previous paper, in which I have shown [*] that variations both in the extent and in the temperature of the warm-water current from the Atlantic take place from one year to another, and that even a small increase or decrease in the mean monthly temperature of the surface water of the Norwegian sea causes great variations in the air-temperature of Sweden during the winter months—January to March. The influence of the Atlantic water upon the atmospheric temperature, which is so marked in winter that we might forecast the character of a coming winter from the hydrographic condition of the Norwegian sea in December, is, however, almost obliterated in summer. The earliest phænologic phenomena of the year,[†] *e.g.* the growth and blooming of spring plants, and likewise the commencement of the farming work in Sweden, seem to be ruled by this influence, but not the rainfall and the temperature of the summer months, the time of the harvest, etc. The conclusion that the inflow of the Atlantic water rules our climate in the winter, but not in summer, is also borne out in the most conspicuous manner by Dr. N. Ekholm's charts [‡] of the temperature isanomalies of the Scandinavian peninsula in January and in July.

The relation between the hydrographic condition of the sea and our summer climate is far more obscure. The only thing which can be said with certainty is, that the extent of the ice-filled area of the Norwegian sea in spring exerts an influence upon the barometric pressure, the rainfall, the harvest, etc., of North-Western Europe. At least it has been found so in the extremest cases of dry and hot or cold and wet summers. It is remarkable that this influence appears to be stronger developed in Denmark, Prussia, etc., than in Sweden and Norway. The Berlin meteorologists, Dr. W. Meinhardus [§] and Dr. Brennecke,[||] have lately published some highly interesting papers upon this subject.

The mighty upper layer of the Baltic ("Deckschicht") absorbs a great quantity of heat during the summer, which in autumn and early in winter is given up to the atmosphere. This exerts a strong influence upon the climate of the Baltic islands, Bornholm, Gotland,[¶] and others. Prof. T. Homén, leader of the international hydrographic research in Finland, has of late published successful forecasts of the climate of the coming winters based upon the hydrographic temperature series of the Finlandish Hydrographic Commission. It can be foreseen that these questions will attract great interest in the future.

This paper is not a treatise upon oceanic circulation in general, but a study of one of its causes, viz. the influence of ice-melting. The first clearly expressed suggestion that the melting of ice in sea-water must occasion a movement of the surrounding water, I have found in a treatise of F. L. Ekman. The first diagram of deep soundings which reveals the fact that a layer of warmer water is found at a certain depth under the surface of the ice-filled regions of the ocean, I have found in the Reports of the *Challenger* observations * in the Antarctic ocean.

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[*] "Ueber die Beziehungen zwischen hydrographischen und meteorologischen Phänomenen," *Meteorologische Zeitschrift*, August, 1896, pp. 285 and 310.

[†] O. Pettersson, "Hvilka äro orsakerna till vegetationsperiodernas tidigare eller senare inträdande under olika år?" *Svenska Landtbruks-Akademiens tidskrift*, 1899. H. 1, p. 3.

[‡] N. Ekholm, "Sveriges temperaturförhållanden jemförda med det öfriga Europa," *Ymer*, 1899, ii. 3, plates v. and vi.

[§] Meinhardus, "Der Zusammenhang des Winterklimas in Mittel- und Nordwest Europa mit dem Golfstrom," *Zeitsch. d. Gesells. f. Erdkunde*, Berlin, xxxiii., 1898.

[||] W. Brennecke, "Beziehungen zwischen der Luftvertheilung und den Eisverhaltnissen des Ostgrönländischen Meeres," *Ann d. Hydr.*, xxxii. (1904), ii. p. 49.

[¶] O. Pettersson, *Met. Zeitsch.*, Aug., 1896, *l.c.*, p. 300–302.

[**] "Om de strömningar som uppstå i närheten af flodmynningar, etc.," *Öfvers. K. Vet. Akads. Förhandl.*, 1875, No. 7, p. 98. Ekman points out that a surface current emerges from ice which melts in sea-water. Water from the deeper layers is attracted

The way to penetrate further into this subject seems to be twofold: We must determine the accelerating forces existent in the water itself from simultaneous observations of the density at different depths in the ocean over a large area. With these observations we must combine measurements of the actual direction and velocity of the movement of the water in all depths.

From both kinds of observations combined we shall be able to draw important conclusions as to the relative influence of the physical and the mechanical causes of oceanic circulation. The first "synoptic" material is, for a certain part of the ocean, provided by the international investigation of the sea. The second can only be collected by the use of current-meters of modern construction. I shall be glad to put an instrument of this kind at the disposal of the first expedition that will undertake the grateful task of determining for the first time the under-currents of the ocean between the Açores and the African coast, or between Rockall and Ireland, or between Iceland and Jan Mayen from an anchored boat or buoy.

REVIEWS.

EUROPE.

Flora of the Alps.

'Geschichte und Herkunft der Schweizerischen Alpenflora. Eine Übersicht über den gegenwärtigen Stand der Frage, von Marie Ch. Jerosch.' Leipzig: W. Engelmann. 1903. Pp. vi. and 253.

The book before us is the result of a searching inquiry into the history and origin of the flora of the Swiss Alps, it being the intention of the authoress to show what is our present knowledge of the subject.

During the Miocene epoch the plains were covered with a subtropical vegetation, of which now fossil remains only are found; the alpine parts of Eurasia and North America were, however, producing analogous alpine floras. During the first glacial epoch, the plants were driven from the high mountains—except, perhaps, a few well-sheltered individuals—down into the plains. The northern forms also moved towards Central Europe. A tundra was thus formed between the ice of the north and that of the alpine districts, of which we have fossil remains preserved. When the ice again retreated a general exchange of plants took place, and Arctic plants went into the Alps, and alpine plants passed to the north. Therefore, in addition to the few Tertiary alpine plants, which were not driven down by the ice, we get in the Swiss Alps arctic and alpine plants from various sources. Such an exchange took place after every one of the three ice ages. After the third ice age, the exchange was so great that the limits of the various periods cannot now be properly traced.

The interglacial periods are shown, from the nature of the fossil plants found, to have been much warmer than to-day, and the persistence of the Tertiary alpine

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to the spot by "reaction," *i.e.* by the influence of the friction of the outflowing surface water. Ekman declares, however, that the influence of ice-melting upon the oceanic circulation is insignificant in comparison with the effect of rainfall, evaporation, etc.

* '*Challenger* Reports.' J. Murray on "The Deep and Shallow Water Marine Fauna of the Kerguelen Region of the Great Southern Ocean," *Challenger Reports*, vol. xxxviii. part ii., No. 10, p. 349.

plants in the Swiss Alps during these periods is another reason why it is not now easy to make out the influence of each separate glacial epoch.

The apparently mysterious and local occurrence of certain species may be due to the wind, especially in the case of hill-sides exposed to southerly winds, which are apt to produce Mediterranean forms. It may, however, be due to historical causes, the ice persisting longer in one place than another, or finally to modern ecological conditions. Changes are brought about now by the cutting down of forests, which results in the formation of new localities. The continual cutting of the grass may turn a flowery alpine mat into a monotonous carpet of Gramineæ. The nibbling by cattle has the same effect. The influence of man, in limiting the area of distribution of certain species, is, however, still little felt in the Swiss Alps. But disregarding even this influence, the flora and vegetation of the Swiss Alps has not yet quite settled down.

O. V. D.

CENTRAL ITALY.

'Hill Towns of Italy.' By Egerton R. Williams. Smith, Elder & Co. 1904. Pp. x., 398. *With a Map.*

This book demands neither detailed criticism nor much praise. It is a *congeries* of impressions, not particularly illuminating, on certain towns in the hills between Florence, Urbino, and Rome; some of them, it is true, but little visited, others of too high a fame to need the delineation of the impressionist. The book becomes interesting at one point, however. This is when the author was guided, in the neighbourhood of Viterbo, to a locality, little known on account of the brigandage prevalent until recent times, where an early Roman or Etruscan bridge was found to lead to a town wall almost covered by underwood. What lay beyond it was not ascertained, but it was enough to suggest that exploration (apart from excavation) is still to be carried on in Italy. But it is a sorry task to follow an archæologist who is content with the statement that the palace of the Farnese at Caprarola was built "a century or two later" than the castle of the Orsini. The book is illustrated with very beautiful photographs, some of which admirably show the striking positions of these rightly named "hill towns."

O. J. R. H.

GEOLOGY OF BOSNIA AND HERZEGOVINA.

'Geologischer Führer durch Bosnien und die Hercegovina, herausgegeben anlässlich des IX. internationalen Geologencongresses von den Landesregierung in Sarajevo.' By Dr. Friedrich Katzer. Pp. 280.

Though ostensibly a handbook for the use of members of the International Geological Congress of 1903, who took part in the excursion through Bosnia and Herzegovina, this book is of more permanent interest as an interesting and well-written introduction to the geology of these countries. Prefaced by a general description of the geology of Bosnia and Herzegovina as a whole, the greater part of the book is devoted to a description of the route followed by the excursion, which is mainly geological, but contains some information of more purely geographical interest. We may specially mention a very interesting account of the iron industry of Vares, where over 40,000 tons of charcoal iron are produced annually, together with a brief history and description of the antiquated methods of manufacture which have been supplanted by a more modern system; of the great travertine terraces of Jajce; and of the Popovo polje, one of those remarkable depressions in the limestone country of Herzegovina, which are watered by subterranean streams, and alternately lakes and fertile plains, with the rise and fall of the waters. An excellent index adds largely to the utility of the book.

R. D. O.

ASIA.

JAPAN BY LETTER.

'Present-day Japan.' By Augusta M. Campbell Davidson, M.A. Fisher Unwin. 1904. Pp. xiv., 331.

There is something very attractive about the well-written letter as a medium of conveying general impressions of travel. Miss Davidson did not suppose, when writing her letters, that they would make a volume; but it is well that they have been caused to do so. They have the additional advantage of having been carefully relieved of matter of purely personal interest, and have been run together in consecutive narrative form. The writer is certainly a model correspondent. Her powers of observation are of the keenest, and are not merely superficially applied. The most instructive and erudite chapter is certainly the last, in which the Japanese drama is described and its evolution discussed; but as there is not yet a science of histrionic geography, this, the most praiseworthy section of the book, may be passed with mention. Like the majority of travellers in Japan, Miss Davidson has been imbued with the interest provided by the people, their life, history, traditions, and religion, somewhat to the exclusion of description of the country from her letters. Street scenes in the towns, life in the country inns, flowers and trees, and Fujiyama, we have as usual. A picture of the country apart from its people and their works is lacking, but this can be forgiven a correspondent so clear and enlightened. O. J. R. H.

GEOLOGY OF JAPAN.

'Outlines of the Geology of Japan.' Descriptive Text to accompany the Geological Map of the Empire, on the scale 1:6,000,000. Compiled by the officials of the Imperial Geological Survey of Japan. Tokyo: 1902. Pp. vi. + 251.

The authors of this book have interpreted its scope, as an accompaniment to the first tolerably complete geological map of Japan, too literally to make it a connected and interesting account of the geology of Japan, but have succeeded in producing a very useful summary of what is known of the exposures of the various geological formations which are found in Japan. To a large extent the fault which has been found, if fault it be, is inherent in the subject, for the great apparent simplicity and unity of the great curve of the Japanese islands finds no reflection in their structure. They are remnants of an old land surface, the greater part of which has now sunk beneath the sea, and the great dislocations which caused this breaking up, none of them older than the Tertiary era, are independent of and cross, more or less obliquely, the structure lines displayed in the islands, and the unsubmerged remnant of land is divided into a number of geological areas, with so little unity that the principal structural break crosses the main island, dividing it into two halves, which contrast as strongly in geological structure as in surface features. One result of the geologically recent formation of the Japanese islands, by submergence, is their large number; those exceeding 4 kilometres in circumference being over four hundred in number, while the length of coast-line exceeds the circumference of a circle of equal area in the proportion of 12·8 : 1, and to this extended coast-line we may attribute the development of those qualities which have made the name of their inhabitants as sailors. Little is seen on land of the fault lines which have determined the general trend of the islands, for they lie beneath the sea, and are in them the origins of the majority of the world-shaking earthquakes which start from Japan. The lines of volcanoes are independent of the structure-lines of the older rocks, and, on the whole, follow the direction of the more recent series of dislocations, with which they seem to be genetically connected; but it is a mistake to suppose that Japan is all volcanoes. Though 165 are known, of which 54 are classed as active, the total area occupied by volcanic rocks is only 19·16 per cent. of the whole area of the Japanese empire, at its present limits.

More than half the volume is devoted to economic geology, and here, too, the purpose of an accompaniment to the map is strictly kept in view. We have a series of descriptions of individual mines or groups of mines, and only in the case of coal and petroleum is there even an attempt at a review of the production of the empire as a whole. Coal is the most important mineral industry, the production in 1899 having been 6,721,798 tons; of petroleum, the production was less than $\frac{1}{180}$ part of the amount imported. Precious metals were represented by 28,500 ozs. of gold, 1,246,300 ozs. of silver, and 18,300 tons of copper; and in a country containing so many volcanoes, it is not surprising to find that sulphur is represented by a production of 8450 tons. R. D. O.

BITHYNIA.

'Forschungen auf der Bithynischen Halbinsel.' Von Dr. Rudolf Fitzner. Illustrated. Pp. 183. Rostock: Volckmann. 1903.

Dr. Fitzner, after some residence in Constantinople, undertook, in 1900, an exploration of the small peninsula which immediately faces the capital in Asia and was part of ancient Bithynia. He describes the routes in the first part of his report. They took him as far inland as Adabazar, and enabled him to gain a general idea of the geological structure and actual superficial condition of the country. He summarizes his results in two concluding chapters, in the first of which he makes some attempt to elucidate the problem of the original formation of the Bosphorus. But he admits that he does not solve it, and the map at the end will show how imperfect our knowledge of the relief of the nearest bit of Asia still remains.

AFRICA.

CYRENAICA.

'Cyrenaïka als Gebiet künftiger Besiedelung.' By Dr. Gotthold Hildebrand. With Preface by Dr. Th. Fischer. Pp. xv., 304, *and Four Maps*. Bonn: Carl Georgi. 1904.

This is a careful compilation of the geographical facts recorded concerning the coastal district of North Africa which intervenes between Egyptian and Tripolitan territory. The author has first to define the "Cyrenaika," and tries to show that there is a morphologic unity in all the plateau region which projects like a bastion into the Mediterranean between the Gulfs of Sidra and Sollum, and not merely in the strictly Cyrenaic highlands. The last-named gulf and the Wady Fareg are fixed as the eastern and western limits; the sea is on the north; and a very ill-defined boundary is found on the south in a doubtful line of escarpment running diagonally south-eastward from the mouth of Wady Fareg to the oasis of Siwah (Ammon). This region is generally arable, in sharp contrast to its surroundings, and certain parts of it, especially Jebel Akhdar, on whose crown lay ancient Cyrene, and the small deltaic plain of Derna, are distinctly rich. The purpose of the book is to illustrate the capacity of a not distant, but singularly ill known land to receive and support European colonists; but it has been written in ignorance of the actual process of colonization which has been going forward in the Cyrenaica these two years past. The German, Italian, or British settlers, expected by the author, have in fact been anticipated by Cretan Moslems, planted by a paternal government on various points of the coast from Tobruk to Bengazi, and in other inland localities, *e.g.* 'Ain Shahat, Cyrene itself. These laborious and careful agriculturists, former owners of the richest Cretan lowlands, are even now reintroducing a settled element into a nomadized country, and making parts of it bloom as of old.

The author lays stress on the central situation of the Cyrenaic projection in relation to the East Mediterranean basin, but admits its grave lack of coastal advantages. As a matter of fact, there is no safe anchorage for a vessel of even moderate burden at any point of the Cyrenaic shore, except Tobruk. The fortnightly Italian steamer, which alone serves Bengazi and Derna, has often to omit its visits; and the old port of Cyrene, Apollonia, now Marsa Susa, offers an even more dangerous roadstead. On the inland side, also, though Dr. Hildebrand shows that the Cyrenaica offers a much nearer outlet to the central North African trade in ivory, ostrich feathers, etc., than either Alexandria or Tripoli, he admits that the desert spaces to be traversed in passing from Wadai to Bengazi are so formidable, that the slightest inducement or pressure diverts caravans from that route. He hopes, however, that a railway may some day be made from the Cyrenaica to Chad. By stating these advantages and disadvantages, he incidentally shows why ancient Cyrene had so brilliant, but so short a life. So soon as Egypt was Hellenized on the one side and Tunisia Romanized on the other, Cyrene lost the place which had been hers while she was the one European settlement of importance in North Africa. Natural conformation tended to make what Central African trade there was flow towards Berenice (Bengazi), and the more fertile plateau, farther advanced with the Mediterranean, lapsed to the desolation which now possesses it. Though the strong coastal currents tend to neutralize the formation of littoral plains, the soil of the plateau is deep and rich, the climate is temperate, and, despite the prevailing limestone structure, springs are comparatively abundant. To the four fountains of Cyrene enumerated by the author we can add a fifth on the north-east of the site, and we believe there are others on the ridge eastward.

Dr. Hildebrand has compiled from travellers' and consuls' reports statistics of production, and promises a future for several cultures, especially the olive and barley. But we doubt if the statement made by a French writer in the seventies, that the Cyrenaic grain was in great demand by British brewers, was worth repeating. The only faults we have to find with this useful book are that its author uses all sorts of authorities with little discrimination, and does not give quite enough information about them. For example, the list of works bearing on the Cyrenaica, given as an appendix, would be ten times as useful if there were some classification, involving statement of which are of first-hand and which of second-hand authority, and to what parts (if any) of the country their authors had penetrated.

D. G. H.

THE SUDAN IN THE MAKING.

'The Binding of the Nile and the New Soudan.' By the Hon. Sidney Peel. Edward Arnold. 1904. Pp. vi., 288. *With a Map.*

Mr. Peel has a happy simile for the New Sudan. "No one," he says, "whose lot it has been to travel through the night on the plains of a tropical country can forget the amazing effect produced when the sun, with one great leap, as it seems, springs clear above the horizon. And in a moment the world's face is altered." So appears the Sudan, peaceful and progressive, where "the din of battle has hardly ceased to echo." Whether on the subject of the newest benefits wrought upon Egypt by recent irrigation schemes, or on that of the Sudan under British rule, the story is very pleasant reading. As regards the binding of the Nile, former and present systems of irrigation, the construction and working of the Assuan dam and the new barrages, and the clearing of the sudd, are here described very thoroughly, but without technicalities unintelligible to the ordinary reader. Passing to the Sudan, Mr. Peel gives two grim chapters on its history; then follows the simile quoted. The horizon lightens, as he describes, the Phœnix-like town of Khartum, already beautiful in its new birth. From it he shows the development of the region in every direction—in administration, educational development, commerce and agriculture, finance. This is a record of steady yet wonderfully rapid progress. In the hope and belief that this progress will continue, the book may be characterized as essentially one of the moment, but for the moment it is very well worth reading. The map is a coloured diagram, according to which there are a mountain or two west of Fashoda, but none at all in Abyssinia.

O. J. R. H.

AMERICA.

Ulrich Schmidel and the La Plata.

'Viaje al Rio de la Plata (1534–1554), notas bibliográficas y biográficas por Bartolomé Mitre.' Prólogo, traducción y anotaciones por Samuel A. Lafone Quevedo. Buenos Ayres: Cabaut y Cía, Editores.

This is the first volume of the "Collection of rare or inedited books upon the region of the Rio de la Plata" which has been published under the auspices of the Junta de Historia y Numismática Americana, of Buenos Ayres. This new society has a splendid field for its labours, and we may expect results of great historic, ethnographic, and geographical importance from its researches under the able leadership of its president, General Bartolomé Mitre, so well known as a soldier, statesman, and historian. Its list of "active members" comprises some of the best literary and scientific talent of the Argentine Republic.

Fortunately, three adventurous soldiers, at the time of the Spanish conquests in the New World, were impelled to chronicle their experiences and describe the countries through which they marched—Bernal Diaz del Castillo in Mexico, Pedro de Cieza de Leon in the Andean region, from Panamá to Chile, and Ulrich Schmidel in the Plata valley. The first wrote fifty years after the conquest of Mexico. His was the simple narrative of an old and honest soldier who had faithfully followed Cortes, even in his Honduras campaign, and whose scars were the principal reward that remained to him from the 119 engagements in which he had displayed his exhaustless valour. In homely but convincing language, he frequently contradicts the statements of his overshadowing companion Gomara, whose polished and flattering pen could hide the failings of Cortes in the splendour of his remarkable exploits.

Cieza de Leon, gifted with rare powers of observation and good judgment, launched himself into the whirlpool of plunder and greed at the isthmus of Darien when only fourteen years of age, and took part for several years in its scenes of broil and battle. His works might well be called the Exploration and Geography of the Andean region. From the moment he decided to chronicle his experiences and to describe the country and its people, he never faltered in his arduous and self-imposed task. The reason which he gave for assuming this was, "that in all parts where I had been no one was engaged in writing anything concerning what had occurred, and time destroys the memory of events."

Of these three great chroniclers, Ulrich Schmidel ranks lowest in point of literary merit, but his work is invaluable, and this humble, common soldier is justly characterized as "the first historian of the Rio de la Plata." Mitre says of him, "He relates events dryly and concisely, fixes dates, determines distances, describes what he sees according to his understanding, without ornament of style or deviation. He only occasionally forms a judgment, makes a reflection, or gives ethnographic data, statistics, astronomic or of natural history. In a few strokes he presents us with a picture, sketches a district, describes an animal or plant, gives us an idea of races and lost customs, supplying at the same time precious elements for the chronology and initial history of colonization of the Rio de la Plata by the European race."

The octavo work under review devotes some 30 pages, by General Mitre, to the biography of Schmidel, giving evidence of profound and laborious research. It is accompanied by Schmidel's genealogy from 1364. In a prologue of about 100 pages, the translator, Prof. Lafone Quevedo, analyzes the narrative of Schmidel, and compares his statements, especially those relating to geography and ethnology, with all of the data relating to the country and its Indian tribes which have been accumulated by the linguistic section of the Museo de la Plata over which he worthily presides. He thus elucidates the relation of Schmidel, and makes it doubly interesting to the student of the discovery and conquest of South America.

An appendix of 100 pages contains ten historical documents, most of them not previously published. Upon these are founded many of the arguments of the prologue. Besides eighteen plates, reproduced from the old Latin edition of Hulsius, there are three maps, one from Hulsius, another the Gran Chaco of Jolis, which is one of the best ethnological maps of the eighteenth century, and a third which is from the original map of Delisle, which, although of date 1700, probably represents information gathered in the sixteenth century.

In comparing this new Spanish translation with the English one published by the Hakluyt Society in 1891, under the title of "The Conquest of the River Plate," we are struck by the elaborate care which has been taken to verify the statements of Schmidel with information gathered from every available source. The translation has been made from the latest German edition, and confronted with all of those which have preceded it, the first of which was published in 1567 from the original manuscript of Schmidel in German. This abounds in orthographic errors, making the names of persons, tribes, and places unintelligible.

It was from the edition of 1567 that the English translation was made, faithfully adhering to the text without rectification, except in part by explanatory notes. The brilliant introduction was by Don Luis L. Dominguez, who, according to Prof. Lafone Quevedo, severely criticized Schmidel for many of the defects in his narrative for which he was not responsible.

The literary movement in the Argentine Republic is remarkable. A group of highly cultured writers, in the city of Buenos Ayres, has already made that great and thriving emporium the principal seat of learning of the southern half of the New World. The numerous works which they have published abound in valuable information, especially regarding the history of the Spanish colonial period, and the geography and ethnology of South America. They are characterized by admirable freshness of thought and broad liberal views. The volume before us is one of the many proofs of this, and makes us hunger for a second one from the Junta de Historia.

George Earl Church.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Desert Flora.

'Desert Botanical Laboratory of the Carnegie Institution.' By F. V. Coville and D. T. MacDougal. Washington: the Carnegie Institution. 1903. Large 8vo, pp. 58. *29 plates, 4 figures in the text.*

Botanists going to the tropics generally choose those districts for carrying out research in which the conditions affecting plant-life are favourable. For this there are two reasons. The scientist, on the one hand, naturally desires to see the tropical flora in its highest and most luxuriant development. On the other hand, botanists who are sent out by their Governments for the purposes of economical research, naturally go to districts where the conditions are such as to make the cultivation of useful plants possible. It is thus that the investigation of the desert flora has been very much neglected, the plants of the desert making a poor show for the botanist travelling abroad for the first time, and they are of no great value to the practical botanist. Our knowledge of tropical rain-forest vegetation is already very extensive, and there are quite a number of laboratories at which work, economical and scientific, can be carried out. Although some work on desert plants has been done—and I need only mention here the name of one author, Volkens—the conditions of plant-life in the desert are still almost unknown.

The establishment of a Desert Botanical Laboratory by the Carnegie Institution therefore marks the extension of botanical research in a direction hitherto but too much neglected. The laboratory is situated near Tucson, Arizona.

We have before us the first report of this Laboratory, which may thus be said to be in working order. The report first contains a few introductory remarks on the history of the movement to establish a desert botanical laboratory, the object of which should be "to thoroughly study the relation of plants to an arid climate and to substrata of unusual composition."

About twenty pages are taken up with a description of the places visited during the laboratory location trip, the remaining part of the report being devoted to a few brief botanical, meteorological, geological, and other observations, which must be considered to be of a preliminary nature. The report is illustrated by a number of very good reproductions of photographs, one of which (plate 11) shows the new laboratory, nestling on the slopes of the Tucson mountain, and surrounded by a typical desert vegetation, of which grand cactuses, 20 to 30 feet high, form a very prominent feature.

O. V. D.

The Atoll of Funafuti.

'The Atoll of Funafuti. Borings into a Coral Reef and the Results.' Being the Report of the Coral Reef Committee of the Royal Society. Published by the Royal Society. 1904. Quarto. Pp. xiv., 428. *With 29 Maps, 6 Plates, and 69 Cuts in Text.*

Perhaps a feeling of keen disappointment cannot but dominate as one turns away from the account of the work of the Funafuti expeditions. A full account of a boring successfully put down to a depth of 1114½ feet is before us, but yet the question of the formation of atolls in general—and one might almost add of Funafuti in particular—is in the same position as it was in 1903. No fault can be found with the conception of the work, nor with the mode in which it was carried out. Some of the ablest men of England have ungrudgingly given their time during the last seven years to the task of examining the materials, but yet the fact remains that not a single one of the important questions, in connection with the formation of coral reefs, has been definitely solved. This result may be due to the choice of Funafuti as a typical atoll, but in 1895, when the first expedition was arranged, the wide differences which we now know to exist between reefs were not anticipated.

Time and money, however, have by no means been wasted. Our disappointment is unjust, due to an unreasoning anticipation of definite results, and with the facts before us will be readily dispelled. For the first time a vertical section of over 1000 feet of the limestone of a coral island is portrayed with such minuteness of description and wealth of detail, that we can each draw our own inferences. The editor prefers to leave it thus without giving his views, perhaps a wise decision in view of the contradictory nature of the evidence, and the very numerous additional points on which we *now* desire information. While we may criticize one point or another, we freely recognize the enormous value of the solid mass of fact, which forms the greater part of the volume.

The first expedition, in 1896, under Prof. Sollas was a failure, putting down two bores of only 105 and 72 feet, owing to the gear having been unsuitable to the unexpectedly cavernous nature of the rock. Captain A. M. Field and the officers of H.M.S. *Penguin*, which carried the expedition, made a thorough and minute survey of the atoll, a comparison with which in twenty-five or fifty years may be expected to yield valuable results. A second expedition in the following year, under Prof. David, reached a depth of 698 feet, and was responsible for a large-scale geological map of the encircling reef, based on the topographical survey of the Admiralty. Finally, the boring was completed in 1898 by Mr. Finckh, who also gives us a biological account of the whole reef-formation.

The most interesting of the preliminary reports is that of Prof. David on the geology of the atoll, in which he contends that its somewhat peculiar shape has been determined independently of the direction of the prevailing winds and currents. The visible foundation rock of the greater part of the reef platform is formed of Heliopora and Porites *in situ*. Since the time that these corals flourished there would seem to have been at least three oscillations of level, two upward separated by a downward one, the last, as shown by the level of the land, a sinking of the shore-line for at least 14 to 16 feet, due to an elevation of the whole atoll reef or a drawing away of the sea. It is suggested that the same sinking of the shore-line still continues, though it is difficult to understand why it is accompanied by a general denudation of the land, the materials of which are being washed into the lagoon. If this is the case, and if the last movement, as is supposed, is still in progress, the lagoon should be silting up, but it scarcely appears to be so except in certain protected situations, where the effect is due mainly to the growth of Halimeda, a frondiform calcareous alga, and the deposition of foraminifera. This relative absence of silting is mainly ascribed to the tidal scour, which is stated to have caused a deposit of about 300 feet in thickness off one of the western channels of the atoll. Perhaps the scour is also responsible for the submarine cliff of 1 to 4 fathoms which in most places bounds the lagoon. The observations that angular rubble, "even when bedded in water subject to swift and variable currents, came to rest at angles at least as high as 40°," and that "the foraminiferal sand rests at an angle of 33°, even when bedded in the moving tidal water," have an important bearing on one view of the formation of coral reefs, as does also Prof. David's conclusion that such angular material "may attain a dip of 60° or 70°, or even become vertical, through becoming cemented by" various organisms. Further, the action of humic acid in the formation of sandstone and of depressions in some of the encircling island is not without interest in connection with the solution hypothesis of lagoon-formation.

The cores and other materials from the borings have been worked out under the direction of Prof. T. W. Judd, who is also himself responsible for their chemical examination, while the mineralogical changes have been undertaken by Dr. Cullis. Of greatest interest to the students of the coral-reef question will be Dr. G. J. Hinde's 'Report on the Materials of the Borings,' 176 pages, mostly of small type. A work of such magnitude, of such difficulty and novelty, and of such a minutely detailed nature has never before been attempted. The examination of the core from the main boring entailed the preparations of upwards of 1100 really separate reports and the identification of many thousands of organisms, while accounts are also given of the two first borings and of those in the lagoon. In all about 400 feet of core were obtained, varying in diameter from 4 inches to 2½, every piece of which had to be sectioned and minutely examined. In truth, Dr. Hinde is to be congratulated on the completion of his great task, and in having contributed to science a standard work of the highest permanent value. We would only venture to suggest that the addition of a few plates of representative sections of the core at different levels would have made the description more graphic and much simpler to readers, who are not specialists, and would have enabled them the more readily to have appreciated the various points which arise.

The result of the examination of the materials may be best expressed in Prof. Judd's words: "Dr. Hinde's carefully drawn up lists show that from top to bottom (of the core) the same organisms occur, sometimes plants, sometimes foraminifera, and sometimes corals predominating; but in the whole depth bored the same genera and species of the various groups of organisms take their part in the building up of the mass." *But does the boring run through a talus slope or a reef that has gradually subsided?* Unfortunately, Mr. Finckh's somewhat scanty account of the biology of the atoll is of no value to us, since the conditions governing it have greatly changed owing to the recent oscillations of level. A little dredging was due on the outer slope as deep as 200 fathoms, but it was too slight to be of much real value. The ordinary consolidating organisms may—and it is stated that Lithothamnion, the most important, does—live down to the required depth, and, further, a talus may, according to Prof. David, be formed even vertically. The latter conclusion largely invalidates any deductions from the statement that the corals of the core are very frequently in their growth-positions. Further, sedentary organisms, and particularly corals, appear to be so difficult to orientate that the full evidence of growth-position might have been given with advantage in a few of the best cases, with perhaps sections of the core. Considering the peculiar nature of the core down to about 750 feet, and its complete consolidation thereafter, and also its small size, it seems dubious whether the presence or absence of definite stratification could have in any case been determined or even expected. Indeed, the report seems to give no answer to our question, though there is much in it which may be quoted—and questioned—in accordance with the views and knowledge of different observers.

In conclusion, we may again be permitted to emphasize the great permanent value of the whole report. It is ably edited by Prof. Bonney, and is throughout characterized by a complete freedom from bias of any sort. It is the centre from which future research will largely radiate, and with it as a basis we may expect a flood of light from the examination of elevated coral reefs and limestones all over the world. The more the various reports on the cores are studied, the more will their immense value be recognised.

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

The Mediterranean Region.

'Das Mittelmeergebiet—Seine geographische und kulturelle Eigenart.' By A. Philippson. Pp. vi., 266. *Illustrations and Maps.* Leipzig: Teubner. 1904.

A well-known writer on the physical characteristics of the Greek peninsula makes herein a useful contribution to regional geography by treating the Mediterranean with its islands and coasts as a whole. The frontiers of his *Mittelmeergebiet* are, perhaps, somewhat vaguely drawn; for by no means does he take account of all the hydrographic basin of the Middle Sea, nor even of the orographic limits which he himself prescribes. For instance, neither the Alps nor the main chains of the Balkans, though assumed to bound the region, are reckoned as part of it; and this being so, it is difficult to see why the Atlas, and the internal plateau of Asia Minor, should, nevertheless, come into the author's purview. If the extent of *hinterland* to be included is somewhat arbitrary, it is, however, not less useful to have a comprehensive consideration of the sea itself with its shores. Dr. Philippson finds a geological unity in the region by regarding it all as a "Bruchzone," included within one volcanic area, which may be distinguished into a western and an eastern sub-area; and as characterized in great part by a common earth-movement, viz. subsidence. Evidence that coastal movement on a large scale in certain parts of the region did not cease with the post-Pliocene epoch, but has continued in historical times, and is probably going on still, accumulates fast. We have had before us recently Mr. Günther's observations upon the Neapolitan seaboard; the archæologists have been demonstrating still more lately the subsidence of the Nile delta in post-Roman times; and we have ourselves observed indubitable evidence of the same movement on the Cyrenaic shore.

Dr. Philippson classifies the borders of his sea into *Schwemmlands-Kuste*, *Erosions-Kuste*, and *Ingressions-Kuste.* A better classification might be dual, the true distinction being between the first and third. "Erosions Kuste" results from a secondary process, which modifies coasts formed primarily under one or two other of the remaining heads. But, at any rate, Dr. Philippson's classification serves to distinguish obvious varieties. A more serious objection might be found in the general unevenness of treatment, noticeable in this book. At least twice as much space, attention, and detail are devoted to the eastern Mediterranean as to the western, doubtless because the author has much more intimate personal acquaintance with the former area. The Spanish, French, Italian, and African coasts are surveyed very cursorily, and the treatment only becomes satisfactory when the Adriatic and the Ægean are reached. Further, it is perhaps inevitable that such a general treatise as this should err on the side of generality. Certain distinctions of climate and life-distribution are too sweeping. For instance, central Asia Minor is neither so rainless nor so thinly populated as it is described in Dr. Philippson's text, or represented in his charts. The truth is that we have not yet enough *data* for several of the Mediterranean lands to allow of their being classified on broad lines with that hard systematic precision dear to German science.

With this warning, however, we can heartily recommend Dr. Philippson's book to those who wish to study or to teach the geographical conditions of the Mediterranean lands in their bearing on a long and intricate history. As is right and proper, the author always keeps the historical records in view, and uses them where possible, as, for example, in discussing the question of recent climatic change in the eastern basin.

GENERAL.

THE TURKISH EMPIRE.

'Auf Turkischer Erde.' By Hugo Grothe. Pp. 455, 2nd edit. Berlin: Allgemeiner Verein für Deutsche Litteratur. 1903.

This pleasantly written book of travel over paths for the most part well trodden in the near East, reaches a public which a more serious work would not interest. Dr. Grothe has visited various parts of the Ottoman empire during the past ten years. In 1895 and 1896 he was in Tripoli in Africa; in 1900, in Armenia and Transcaucasia; at other dates, not specified, but obviously recent, in Asia Minor and Macedonia. He was not adventurous, if we may assume that he has described pretty nearly all he has seen; for in Armenia he treats only of the great road from Trebizond to Erzerum; in Anatolia, of the German railway routes to Konia and Angora; and in the Balkan lands, of the railways to Salonica and Monastir, and the caravan road, the old Via Egnatia, to Durazzo. In the town of Tripoli he remained some time, and made one trip on a British grain-ship to Bengazi, and a short excursion into the interior south-west of Tripoli. The result of his leisurely and comfortable journeys is a good deal of encyclopædic information concerning racial types, trade, and superficial aspects of scenery. We do not feel that he has pierced below the skin of things, or is a traveller with much special knowledge of or affinity for the peoples of the near East; but he has observed sympathetically and described readably. Perhaps his most interesting chapter is devoted to a visit to the German religious colonies in Transcaucasia. Thither some thousand Wurtemburgers betook themselves about the same time and with the same purpose as the German colonist who settled near Carmel, and there they still await the beginning of the Millennium.

BRITISH COMMERCIAL HISTORY.

'Queen Elizabeth and the Levant Company.' A Diplomatic and Literary Episode. By the Rev. H. G. Rosedale, D.D.

A very small part of this book can be said to come within the purview of a geographical journal. The "Worshipful Company of Merchants trading to the Levant Seas," was not, like some other merchant companies, an exploring association. Its foreign factories were few, and fixed in well-known trade centres, like Constantinople, Smyrna, Aleppo, and Alexandria. The freemen, as a whole, showed no great enterprise or pioneer spirit, and mostly waited for trade to come to them. They were, in short, rather shippers than exploiters, and, with a few notable exceptions, such as Salt of Cairo, and Barker of Aleppo, took little trouble to inform themselves upon, or open out the lands lying behind the coasts. Powerful at first to introduce British sea-borne traffic to new waters, and extend British political influence, the company somewhat outlived its usefulness; and by the end of the eighteenth century was generally regarded as an abuse, a hindrance to commercial expansion, and a drain on the resources of England. Mr. Rosedale has exhumed a document from the Record Office, which bears upon the early history of the Merchant Association, out of which the company grew, but is not of much importance. He has reprinted a little from Hakluyt, and a little from published Venetian archives, and added some portraits and excerpts from contemporary bills of lading, which illustrate the operations of the earliest Turkey merchants. The whole makes a book which strikes us as not very necessary.

THE MONTHLY RECORD.

EUROPE.

Proposed Ship-canal from the Rhine to the Danube.—A recent Foreign Office report by Dr. F. Rose (Misc. Series, No. 613) gives particulars of the project now under consideration for the connection of the Rhine and the Danube by a ship-canal by way of the Neckar. The writer points out the unfavourable position at present occupied by the kingdom of Würtemberg as regards communications, situated as it is off the main highways leading from east to west, and from north to south. If, on the other hand, the double project of the canalization of the Neckar and the subsequent connection of the Rhine and Danube systems were carried out, Würtemberg would be transplanted into the middle of the largest and most important European waterway. From Mannheim to Heilbronn, and from Heilbronn to Cannstatt or Esslingen (the former just below, the latter above, Stuttgart), the bed of the Neckar would be utilized, and from Neckarems (a little below Cannstatt) to the Danube, those of the Rems, Kocher, and Brenz. The total cost is estimated at about £7,000,000, of which some £2,000,000 would go to the canalization of the Neckar. It is, however, thought that the creation of the necessary locks would yield, in the resulting water-power, an asset valued at about £1,300,000. The length from Mannheim to Neckarems would be 110 miles, and thence to the Danube 71½, in all 181½ miles. Among the advantages to Würtemberg likely to accrue from the construction of the canal are enumerated the reduction of the price of coal by the access supplied to the Saar and Ruhr coalfields; the means afforded for the direct import of raw cotton from Antwerp and Rotterdam, and for the cheaper export of manufactured goods; the possibilities of through transport along the Danube, Neckar, and Rhine, by which petroleum, raw sugar, wheat, rice, in fact all the products of the near and far East, could be carried at cheap rates from the Black to the North sea. Most of the countries of Central, South-Eastern, and Western Europe, including the United Kingdom to some extent, would benefit by the execution of the project, which is favourably regarded by both Baden and Bavaria, as well as Würtemberg. Of great importance to Bavaria would be the access afforded to the upper Rhine, and the connection with the existing French and Alsace-Lorraine canal system on the one side, and with Russia, Austria Hungary, and the Balkan peninsula on the other; while the whole of the south of Germany would come into closer touch with the lake of Constance, East Switzerland, and even with Italy. A somewhat similar project has been set on foot in Bavaria for the junction of the Rhine and Danube by the Main, but this is not regarded as a competitor, but rather as complementary to the other.

Is Rumania in the Balkan Peninsula?—M. Alexandre Sturdza, a member of the Rumanian Geographical Society, in a paper lately read before that body, seeks to combat the common practice of classing Rumania as a portion of the Balkan peninsula. The paper has aroused considerable interest in Rumania, and has been printed in French for distribution abroad, with a view to making M. Sturdza's contention as widely known as possible. The writer first discusses the use of the term Balkan peninsula, which he holds is itself unsuitable, the substitute which he suggests being the somewhat cumbrous one "Thraco-Illyrian peninsula;" but apart from this question, he holds that the only lines which could be held, on scientific grounds, to bound the peninsula on the north are either the Balkans themselves or the Danube. Both the geological history of the region and the existing nature of the surface forms are held to sharply differentiate the lands dominated by the Carpathians from those south of the Danube. The Balkans are shown to be more ancient than the Carpathians, and to have formerly belonged to the mountain system which included the Crimea and the Caucasus, while the Carpathians belong to the same orogenic system as the Alps. The hydrographical system of Rumania differs in character from that of the Balkans, no less than the relief and the nature of the soil, while the formation of the modern valley of the Danube, by the fracture at the end of the Tertiary epoch which gave rise to the Iron Gates, has supplied a natural dividing-line between the regions to the north and south of it. Finally, the ethnological characters of the population are held to differentiate them in an equally marked way from those to the south of the Danube. There is certainly considerable weight in M. Sturdza's contentions, but it is to be feared that the convenience of grouping together, for ordinary purposes, the whole of the nationalities to the south of Austria-Hungary and South-West Russia, and the difficulty of allotting, in ordinary atlases at least, separate sheets to each of them, will be an obstacle in the way of the reform advocated.

Forestry in Iceland.—The present position as regards possibilities of tree-planting in Iceland is summed up in *Globus* (1904, No. 16) by M. Lehmann-Filhés, on the basis of investigations by C. V. Prytz, professor of forestry at Copenhagen, who has lately travelled in the island with a view of studying the question on the spot. After referring to the old idea that Iceland possesses a single tree only, the writer quotes extensively from Dr. Thoroddsen to show that woods containing trees of some size do exist in various parts of the island, the climate and soil of which are by no means unfavourable to tree-growth. Evidence, in fact, exists to show that Iceland was once much more covered with trees, which have been exterminated for the most part by reckless cutting and the depredations of stock. The evil effects of this are to be seen in the wide areas of stony ground from which the fertile humus has been entirely removed. Apart, therefore, from the question of the supply of firewood, re-afforestation would exercise a beneficial effect by helping to protect the surface soil, and so favouring cultivation. Prof. Prytz regards the experiment as quite feasible, given a suitable choice of trees and of localities for sowing or planting. He recommends both the planting of trees round the enclosed meadows in the vicinity of farms (as here they would be safe from cattle), and the formation of plantations on the mountain-sides. Something has already been done at Hallormstadur in the way of planting firs and pines, the plants having been obtained from Denmark. Birches already spring up naturally, and it is thought that immunity from destruction by sheep might be gained by sowing these in places where the snow lies deep and long, as it is only in winter when grass is not to be had that the birch appears to be devoured by sheep.

ASIA.

Longitude in Indian Survey Maps.—As is well known, the longitude employed in the maps of the Indian Survey Department has been based on observations made early in the nineteenth century for the determination of the longitude of Madras, which subsequent observations, carried out with improved methods and instruments, have naturally shown to be somewhat inaccurate. But the subject is more complicated than appears at first sight, for not only has the value of the Madras longitude required correction, but the difference of longitude between Madras and Kaliaupur—the starting-point of the triangulation—which was originally obtained by triangulation only, has been likewise proved inaccurate as at first assumed. The history of the various determinations of longitude for the purposes of the survey, and the values assumed at different times, is summarized by Major S. G. Burrard in the 'Professional Papers' of the Survey of India (Serial No. 7, Calcutta, 1903). The longitude used for the great Trigonometrical Survey, which has remained the same throughout, was that obtained by Warren and introduced by Lambton in 1815 (Madras 80° 17′ 21″ East of Greenwich). This value was rendered obsolete in 1877 by the telegraphic determination *viâ* Mokattam and Suez, which differed by 2° 30′ (Madras 80° 14′ 51″), but in view of the certainty that finality had not yet been reached in the process of improvement, no change was made in the longitude employed in the Survey sheets. A still greater approach to accuracy was made by the observations of 1894–96, carried out by Captains Burrard and Lenox Conyngham *viâ* Karachi, Teheran, and Potsdam, to which reference was made at the time in the *Journal* (vol. vi. p. 471; vol. xi. p. 174). This gave the value as 80° 14′ 47″·06. It was usual, after the results of the 1877 observations had been worked out, to append to the sheets of the Great Trigonometrical Survey a note stating that the correction required to make the longitudes accord with the new value of the Madras Observatory was −2′ 30″; the atlas-sheets required a further correction of 1′ 9″. This was, however, not strictly correct, this correction holding only in the case of Madras itself, while for the survey as a whole the correction required was some 7″ less, the difference between Madras and Kalianpur having originally been overestimated by this amount, as alluded to above. Similarly, the correction required to bring the survey into accord with the newest value of the Madras longitude was 2′ 27″, not 2′ 34″, as might have been supposed from a casual reading of the footnotes to the survey sheets (the value of the longitude having been reduced by 4″ as compared with that of 1877). In 1900, the construction of a map of India and adjacent countries on the scale of 1 : 1,000,000 having been decided on, and with it the adoption of a new value of longitude, it became a question whether this should be made to accord with the astronomical value of Madras or that of Kalianpur. The choice fell on the latter, which had likewise been the astronomical origin of latitude since 1840; the result being that the accepted *geodetic* value of the Madras longitude became 80° 14′ 54″ E., while the map of India is placed 7″·14 nearer Greenwich than it would have been had the astronomical value of Madras been taken as the basis. In view of the uncertainty as to the relative accuracy of the two determinations of the difference between Madras and Kalianpur, and the fact that the latter was the starting-point of the whole triangulation, the course adopted was no doubt the wiser, even though it involves the above departure from the astronomical longitude of Madras.

The North-West Frontier Province of India.—The Administration Report from November 9, 1901, to March 31, 1903, estimates the yield for the combined harvests of 1901–2 at only two-thirds of the normal, yet with little difficulty all but 5 per cent. of the fixed land revenue was raised. Pathan agriculture, ignoring the principle of variation of crops, exhausts the soil, which the cultivator does little to reinvigorate. On lands irrigated from mountain streams the silt thrown up suffices in some cases to replenish the soil, but in general scientific cultivation would reap a much larger return. The present sources of irrigation being exploited to the utmost, a project is under consideration for the reclamation of a large tract of land by irrigation from canals from the Indus. A very large proportion of the lands in the province is irrigated from the streams and rivers derived from trans-frontier hills, where the conditions of snow and rainfall vary little, and the lands are practically independent of rainfall within the province. The only important supply of timber has been obtained by the Forest Department from Kagan, where deodar-wood has been floated down the Kunhar and Jhelum rivers. The exploitation of the reserve forests is expected to proceed in the future on a much larger scale than hitherto. In the way of the development of communications, the Ekka road from Murtaza to Wana, through the Gomal valley, is practically completed, except in certain portions of the Gomal gorge. The canal road to Landi Kotal through the Mullagori country has been nearly completed, and the widening of the track into a cart road is projected. The road connecting Dera Ismail Khan with Zhob through the Chuhar Khel Dhana pass is also nearing completion. The buildings necessitated by the separation of the province from the Punjab are well under way. Militia posts are to be built or reconstructed in northern and southern Waziristan. The Swat and Kabul river canals yielded last year a very considerable profit, while a few irrigation channels, owned by the District Board in Peshawar, have prospered financially. The utilization of the waters of the Indus by means of canals at Pehur and Reharpur is projected. Though accurate figures are not easily obtainable, import and export trade is largely on the increase. The trade over the Malakand since 1895 has increased from 10 to 103 lakhs. The figures for the year show an import trade of 88 lakhs and an export trade of 145 lakhs, an increase of 11 and 24 lakhs respectively on the preceding year. The Pathan tribes being scourged by small-pox, 90,000 vaccinations were effected in 1902. The report includes a useful summary of the geography and history of the province and its recent organization as an administrative unit.

AFRICA.

French Expeditions in the Sahara between Algeria and Timbuktu.—Successful journeys have lately been made by two French parties, under the command of Commandant Laperrine and Captain Thiévenaut respectively, who, setting out from Insalah in the north and Timbuktu in the south, effected a junction on April 16 last at a point some distance south of Timissao. M. Foureau, who communicated the news to the Paris Geographical Society, remarks that this confirms his previous opinion that small parties can move with ease and without danger in that region. Commandant Laperrine's expedition was accompanied by a young scientific traveller, M. Villatte, whose careful work will supply a valuable addition to our knowledge of this previously little-known part of the Sahara. The route followed was roughly parallel to that of M. Foureau himself, and as M. Villatte has laid it down with great care by the aid of astronomical observations (including many of occultations of stars by the moon) as well as by topographical surveys, the mapping of this part of Africa will decidedly benefit by his work. He has also obtained valuable geological results, having studied the Devonian and Carboniferous formations which occur beyond the 26th parallel, and obtained interesting fossils.

The Macmillan Expedition.—Mr. W. N. Macmillan, who last year made an unsuccessful attempt to navigate the Blue Nile downwards from Abyssinia to the Sudan, has now succeeded in making the journey in the opposite direction by way of the Sobat. The ascent of the Baro—the upper branch of this river—was accomplished in launches to the foot of the Abyssinian plateau, apparently somewhat further than the point reached by the Marchand expedition in the *Faidherbe*. The Bure escarpment was climbed without unloading the animals, a fact which seems to show that the path must have been improved since Major Austin's visit—possibly by the Abyssinians sent by Menelik to convey the *Faidherbe* by this route to Adis Abbeba. The expedition was accompanied by Sir John Harrington and several other whites, including Mrs. Macmillan.

Scientific Researches in the Ruwenzori Region.—Some interesting notes on the researches of Dr. David, a naturalist apparently of Swiss nationality, in the Congo forest and the western flanks of the Ruwenzori range, are given in a recent number of *Globus* (vol. 86, No. 4). The traveller has distinguished himself by being the first European to secure a specimen of the okapi with his own gun, which will permit for the first time an accurate knowledge of the physical characters and general bearing of the animal. According to Dr. David, the specimens which have been set up in this country and Belgium have been incorrectly treated, which, all things considered, is not surprising. The okapi, although a ruminant, has all the bearing of a tapir, not at all that of an antelope. The markings are much finer than those of the zebra, the stripes being black within white, and almost all double. The back is reddish, especially in the male, the ears enormously long, the mane erect. Some specimens of both sexes possess horns, while others are entirely without, and Dr. David is on this account inclined to distinguish two species. The animal stands from 4 to 5 feet high at the withers. Another find which is interesting from a zoological point of view is that of an armadillo 4 feet long, closely resembling its congener of the pampas. It frequently assumes an erect attitude, supporting itself on its tail and holding the tree-trunks with its powerful fore claws. Dr. David has also ascended the western slopes of the Ruwenzori range to a height which he estimates at 16,700 feet, which, if correct, would be the greatest altitude yet attained. His routes seem to have led somewhat to the north of Dr. Stuhlmann's. The range, he says, is composed of a series of ridges of granite, diorite, and diabase, no traces of basalt or porphyry being seen. The snow-level occurs at about 14,500 feet, but glacier-tongues reach down to about 13,000. Two small moraine-lakes were seen, and a little below them was a third lake of milky-green colour, surrounded by thick vegetation; while a fourth, which was fed by glacier streams, was clear, though of a greenish-brown colour, perhaps derived from the neighbouring moorland. Like other visitors to the range, Dr. David attempts to define the zones of vegetation met with, of which he distinguishes six or seven, though the uppermost four, above the zone of bamboos, all form moorland of one sort or another. The *Senecio Johnstoni* was found up to 12,800 feet. There was a striking absence of flowers, and of the lush dwarf vegetation characteristic of the Alps. Trees ascend higher on the wall-like sides and slopes of the mountains than on the crests and ridges, but no distinction could be traced between slopes exposed to wind, rain or sun, and the reverse. The vegetation observed on the glacier-tongues on which 3 feet of new snow was lying was of interest, the *Senecio Johnstoni* growing with its base almost in the ice, and its roots embedded in the ground-moraine, which was frozen at the surface, though of a higher temperature below. Dr. David hopes to continue his researches in this region.

The Flora of Somaliland.—The latest of Prof. Engler's valuable studies of the vegetation of African regions is devoted to Somaliland, the flora of which, as known from the collections brought home by recent travellers, is discussed in the *Sitzungsberichte* of the Prussian Academy of Sciences (1904, Nos. x.–xii.). After enumerating the travellers to whose labours we owe most of our knowledge of the botany of Somaliland, the writer describes in detail the various provinces into which the area may be subdivided from the point of view of vegetation, enumerating the principal forms characteristic of each. It will be sufficient here to note briefly the general conclusions arrived at as to the history and relations of Somaliland flora. As already suggested in Prof. Engler's 'Hochgebirgsflora des tropischen Afrika,' the flora of the *northern* highlands of Somaliland shows some relationship with that of Abyssinia, but, as a whole, a broad distinction must be drawn between the Somaliland flora on the one hand and that of Abyssinia and the Galla highlands, which are themselves closely related, on the other. The almost unbroken band of high ground which runs through East Africa has exercised a marked effect in isolating the Somaliland flora, from which numbers of families and species well represented in other parts of East Africa are entirely wanting, in spite of the resemblance of climate, soil, and the general character of the plant formations. These missing forms include some typical steppe-plants, such as *Borassus æthiopum*, *Butyrospermum Parkii* (var. *Niloticum*), *Adansonia digitata*, etc. Even the northern uplands show many such negative characteristics. Among the positive characters Prof. Engler notes (in addition to the extraordinary abundance of certain species of succulent plants—*Commiphora* and *Boswellia*) the prevalence of low steppe bush, with an intermixture of isolated tall trees; the abundance of thorns and woody shoots; and, in the driest parts, the formation of short cylindrical or conical stems sending out thin branches. In these respects the flora shows a general resemblance to that of Damara-land, though distinguished from this by a difference of species. A further important element is that of forms belonging to the Eastern Mediterranean flora, which Prof. Engler regards as introduced by the agency of the wind and animals, not as survivals of a more extended flora of this character; the increasing area occupied by steppes favouring the establishment of new species. A different explanation must, however, be given for the occurrence of *Kissenia*, the sole representative of the order *Loasaceæ*, which is so widely distributed in America. Its dispersion must have been a gradual one, and seems to have started from Damara-land, whither it may have made its way in the past from an old land-mass lying between America and Africa. The case of *Kissenia* is one of the many instances brought to light within recent years of the occurrence in Africa (as in Asia) of isolated forms bearing a close relationship to American types.

Navigability of Upper Branches of the Congo.—A careful examination of the courses of the lower Lualaba and Lufira rivers, with a view to test their navigability, was made last year by a Belgian officer, Lieut. Lattes, and the results were outlined in the *Mouvement Géographique* for April 10 and 17 last (with sketch-map). They show that the Lualaba is navigable by steamer between 9° 10′ and 5° 20′ S., although at high water some difficulties occur at the point where the stream makes its exit from Lake Kisale. M. Lattes gives a detailed account of the width, depth, rate of current, nature of the banks, and general aspect of the stream throughout the section examined, and describes especially the *régime* of the river in its passage through the series of lakes and backwaters so characteristic of a considerable part of its course, which serve to regularize the flow and retard both the rise and fall of its waters. Lake Kisale becomes, in the rainy season, an enormous marsh without definite limits, extending from the Lualaba to the Lufira. The floating islands, formed of papyrus and other vegetation, are a feature of the lake, as has been known since Cameron's time. The open water has a depth of 5 to 7 feet, and the lake may be considered navigable throughout the year to steamers drawing 3 feet and less. The lower Lufira is not navigable by steamers when the water is lowest, *i.e.* during September, October, and the first part of November.

Areas of African Territories.—In the latest issue of that useful publication 'Die Bevölkerung der Erde' (*Pet. Mitt.*, Ergänzh. 146), Prof. Supan gives the results of a recalculation of the areas of the political divisions of Africa as delimited by the international agreements of the last dozen years. In certain cases the boundaries are still somewhat indefinite or existing maps defective, so that the figures are still provisional only, but in view of the wide discrepancies in current estimates of the areas it may be of interest to give the figures, converted from square kilometres to square miles. Owing to the uncertainty as regards the boundary between British East Africa and Abyssinia, Prof. Supan has refrained from giving figures for these (except for certain portions of the former), so that he makes no estimate of the total area occupied by the possessions of the several powers. In the table below this is done by supposing the missing boundary to run in a generally east-south-east direction, from the southern termination of the fixed frontier, to the Jub above Berbera, and estimating the areas of the two territories on this basis. Prof. Supan, on the other hand, has preferred to group the various territories into the three main divisions of North-East, North-West, and South Africa (the last including the whole area south of the northern frontiers of the Congo State and German East Africa). These, the author points out, are completely divided off by definitely fixed frontiers,* and the first two are of some political importance inasmuch as the north-east group is mainly under British influence, the north-west under that of France. The southern division is more composite in character. But as these divisions correspond to no natural regions of the continent, no great interest attaches to an estimate of their respective areas. For the area of the whole continent Prof. Supan has adhered to the figure obtained by Trognitz and given in an earlier issue of the same publication. In the following table the territories definitely under British rule are grouped together first, and those under British influence (Egypt, the Sudan, and the Libyan desert) are added subsequently. The figures are in most cases given to the nearest even ten, and those not given by Prof. Supan are in brackets.

TABLE OF AREAS.

	Square miles.	
British Somaliland	59,770	
Sokotra	1,360	
British East Africa Protectorate—		
(*a*) Administered by Great Britain	139,000	
(*b*) Sphere of influence	(180,000)	
Uganda Protectorate	85,840	
Zanzibar Protectorate	965	
Gambia	3,700	
Sierra Leone	26,880	
Gold Coast	78,430	
Nigeria (with Lagos)	360,540	
South Africa	1,188,800	
East African Islands	965	
West African Islands	125	
Total British	(2,126,375)	
Egypt	247,550	
Anglo-Egyptian Sudan	784,700	
Libyan Desert	515,550	
Total under British influence ...		(3,674,175)
French Somali Coast	8,100	
Tunis	64,560	
Algeria	343,180	
French Sahara	1,942,420	
French West Africa	669,940	
French Congo	679,430	
Madagascar, etc.	229,820	
Total French		3,937,450

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* Some uncertainty seems, however, to remain as to the exact direction of the dividing line between the French Sahara and the Libyan desert, which is shown by Prof. Supan in his map as running considerably to the east of south-east, the direction mentioned in the Anglo-French declaration of 1899.

TABLE OF AREAS (*continued*).

	Square miles.	
Togo	33,620	
Kamerun	190,870	
German East Africa	364,970	
German South-West Africa	317,540	
Total German		907,000
Portuguese Guinea	13,070	
Azores, Madeira, Cape Verdes	2,700	
Saõ Thome, Principe	360	
Angola	489,790	
Mozambique	293,480	
Total Portuguese		799,400
Eritrea	42,420	
Italian Somaliland	146,530	
Total Italian		188,950
Congo State		918,810
Spanish West Africa and Islands		84,950
Tripoli		405,270
Morocco		175,830
Liberia		36,800
Abyssinia and dependencies		370,000
Lakes Chad, Tanganyika, Nyasa		33,740
Grand total		(11,532,370)

The total thus obtained for all Africa exceeds that of Prof. Supan (11,498,670 square miles) by some 33,000 square miles; the reason being that the estimates made above of the areas of British East Africa and Abyssinia exceed by this amount the area left for these in Prof. Supan's table, which certainly seems too small. But as his total for the continent is derived from an independent calculation, it is probable that the higher total should be reduced by a curtailment of the amounts given for some of the separate items. The estimate of the population of many of the territories is of course very rough, and the individual figures need not be reproduced here. The grand total obtained is 140,700,000 (or somewhat less than some recent estimates), which gives an average of 5 to the square kilometre, or 13 to the square mile.

The Swiss and African Exploration.—The part played by the Swiss in opening up Africa to geography and European culture is the subject of a recent publication of the Natural Science Society in Zürich. Switzerland has planted no colonies and established no protectorates as memorials and rewards of Swiss exploration. Stalwart henchmen as the Swiss have proved themselves in fighting the battles of other nations, Swiss travellers, too, have been content to execute the commissions, and attach themselves to the expeditions of other powers. These have, as observed by the author of this publication, appropriated the honour as well as profit of Swiss capacity for hard work. Dr. Hans Schinz, who has himself done so much for the botany and zoology of South-West Africa, has therefore by this publication discharged a patriotic service, although the ground covered is not altogether virgin soil, having been already in part broken by a lecture delivered in 1883 by Ch. Faure in Zürich, entitled "Notice sur la part des Swisses dans l'Exploration et la Civilisation de l'Afrique." The general reader will be surprised to find how many Swiss have taken part in African exploration, and how considerable the sum total of their several parts amounts to. The map at the end shows in red colour five different areas of Africa which are the immediate conquest of Swiss explorers. And, outside these more immediate domains, African geography has cause to thank Swiss perseverance and doughtiness. Including missionaries, some sixty Swiss African travellers, not all of them, however, natives of Switzerland, though all at least virtually Swiss, pass in review—and, in consideration of the early death that overtook so many of them, not without a certain air of pathos—in Dr. Schinz's pages. Each of them is briefly characterized by a summary enumeration of his geographical achievements, and a longer or shorter sketch of his life. Among the more notable names are Burckhardt, who in 1788 received his first commission from the British African Association, and opened up the Nile valley as far as Shendi: he bequeathed 350 volumes of Oriental manuscript to Cambridge University; Munzinger (1832–75), the first to make known the geography, ethnology, and languages of large tracts of Abyssinia; Gobat, Waldmeier, and Ilg, inseparably associated with the kingdom of Menelek, which is claimed as an African Switzerland; Keller, who did important work in Somaliland, but in the field of natural science rather than of geography proper; Kaiser, whose work forms a necessary supplement to Dr. Schöller's achievements in Equatorial East Africa; and (to go back to earlier times) Braun (1580–1668), whose book on the region about Kamerun was published at Basel in 1624, and who, though claimed by Georg Henning as the "first German scientific traveller in Africa," was a native of Basel.

AMERICA.

The Mont Pelé Obelisk.—Various suggestions continue to be made for the purpose of accounting for the unusual phenomenon observed in the case of Mont Pelé, where a column of lava, estimated as having had from first to last a total height of 3000 feet, has been extruded in a solid form. On the one hand, the suggestion was made some time ago by Dr. Lane, and lately repeated unconsciously by Prof. G. K. Gilbert (*Science*, June 17, 1904), that the rapid cooling and solidification of the molten magma is occasioned by the loss of heat resulting from the escape of the contained gases, which, in passing from a state of absorption to the free condition, become greatly expanded, thus consuming the energy furnished by the heat of the magma. For the production of the Pelé spine or obelisk, what would be needed would be the arrest of the exclusion and expansion of the gas at the precise stage necessary for the solidification of the magma, the stage in which the solid matter is blown into fragments being thus not reached. On the other hand, the view is held by Prof. Heilprin (*Science*, May 20, 1904), "that the tower was merely the ancient core of the volcano that had been loosened from its moorings and lifted bodily outward by the force of the volcano's activity." Such a phenomenon, Prof. Heilprin points out, is not entirely unknown, for the structures observed by Abich in the Palandokan volcano in Transcaucasia, and by Scrope in the Puy Chopine of Auvergne, seem to have been due to a similar uplift.

British Annexation in the West Indies.—On August 15 last it was announced that Aves island—a small low island rising from ocean depths in about 13° 38′ N., 63° 36′ W.—had been annexed to the British Empire by H.M.S. *Tribune*. The island is rarely visited and but little known, but some details respecting it were given by Admiral de Horsey and another correspondent in the *Times* of August 16. It rises only about 12 to 14 feet above the sea, and is not noticeable even by day until closely approached, so that it forms a considerable danger to navigation. Its total length is only about ¾ of a mile. In 1857 a dispute arose between Great Britain and Venezuela as to the ownership of the island, which contained guano deposits of some value, though of small extent. They seem, however, to have been largely removed by American vessels. There is an anchorage in 6 fathoms on the south-west side, but a heavy cross-swell sets in from both ends. The reason for the annexation has not yet transpired.

AUSTRALASIA AND PACIFIC ISLANDS.

Marcus Island, North Pacific.—This island, one of the minute points land in the wide expanse of the North Pacific, the exact position and even th separate existence of which has till lately been matter of some uncertainty, ha within the past few years come into notice owing to the enterprise of an America guano company, and the question of ownership raised between Japan and th United States as a result of the company's operations, and finally decided in favou of the latter. In 1902, on the occasion of a voyage to the island by one of th company's ships, the offer was made to the Trustees of the Bishop Museum, in Honolulu, to send a scientific observer to investigate the geology, zoology, and botany of this hitherto unexplored spot, and, this being accepted, Mr. W. A. Bryan paid a visit to the island, scientific data regarding which were thus for the first time obtained. They are published in the *Occasional Papers* of the Museum, vol. ii. No. 1 (1903). Owing to unforeseen complications, the stay at the island was much shorter than had been planned, but the week spent in its examination permitted a general idea to be gained of its geographical history and surface features. The centre of the island lies in 24° 14′ N., 154° E., the nearest American soil being Guam, some 1000 miles distant to the south-west. Obscurity seems to prevail regarding the first discovery and naming of the island, and it has frequently been confused with other reported rocks or islets in this part of the Pacific, though its position was ascertained during the voyage of the *Tuscarora* in 1874. It is still uncertain what other points of land exist in its neighbourhood, and from the flight of birds, Mr. Bryan was led to believe that an island will be found some 50 to 75 miles to the north-east of Marcus. The island is roughly triangular in shape, its longest side measuring less than 2 miles. The highest points occur near the angles, the elevation reaching its maximum of 75 feet near the north end. The reef is of the usual fringing type, and though its outer face is jagged and broken, there seem to be only two distinct passages through it. Outside a bottom of solid rock was found on all sides at a depth of 8 to 14 fathoms within a few hundred yards of land. The coasts are formed of coral sand and shingle, with huge blocks of coral rock in parts at a considerable elevation above the sea. A very compact old beach conglomerate was also observed. The surface consists in part of similar materials, in part of sand more or less mixed with humus, and is generally thickly wooded. There are several small depressions, which are evidently remains of an original lagoon, round which the island has been built up. That it is an ancient atoll since elevated above the sea is indicated also by a striking series of steps or bench-like beaches on the eastern side; by the elevated tables of coral rock exposed; and by the huge blocks of coral rock scattered over the surface. The island has been built up also by the action of storms. Soundings in an east-and-west direction show that the island may be regarded as the summit of an elevation of the ocean's floor, due probably to volcanic disturbances, on which the reef-building corals have found a lodgment. It was hoped that an examination of the birds might bring out some interesting distributional features, but this was not the case. Certain sea and shore birds were abundant, but any terrestrial or arboreal birds that might have been accidentally introduced would have perished for want of suitable food. The present political relation with the American Continent is matched by a similar natural relation, shown by the presence of a great log, squared at the ends, which must have been transported by currents from its original home at Puget sound.

POLAR REGIONS.

The National Antarctic Expedition.—Both the *Discovery* and the *Morning* touched at the Falkland islands in the latter part of July, and may be expected to arrive in England about the second week of September. The *Terra Nova* has arrived in England.

Configuration of the North Polar Area.—A tendency has lately made itself felt in some quarters to question the validity of the conclusion, formed as a result of Nansen's voyage, that the north polar area is occupied throughout—beyond the limits of the land surfaces so far known—by an ocean of considerable depth. In commenting on the results of Peary's latest expedition, Prof. Heilprin has expressed the view that it is at least premature to conclude that no further land-masses exist in the ocean north of Greenland, and that certain facts seem rather to point in an opposite direction. A similar view of the possible existence of a large area of land in the unexplored arctic region has been expressed by Mr. R. A. Harris, of the U.S. Coast and Geodetic Survey, who bases his conclusions principally on the currents and tides of the Arctic seas. From the neighbourhood of Bering strait to that of Greenland two main currents are known to flow across the Arctic ocean, the one passing north of Alaska in an easterly direction and on through the Arctic archipelago to Davis and Hudson straits; the other starting north-westwards (as shown by the drift of the *Jeannette*) to the neighbourhood of Bennett island, there bending to the right along the line of the *Fram's* track, and eventually passing into the Greenland sea. That the *Jeannette* did not take a direct northerly route is held to point to the existence of land in that direction, possibly forming a strait in the neighbourhood of Bennett island, which would account for the increased rate of the current in this locality. Again, that land probably extends to the north of Beaufort sea (north of the Mackenzie mouth) is held to be indicated by the great age of the ice in this sea, which would seem to have no broad outlet enabling the ice to escape as it does north of Siberia. The facts so far known in respect of the tides point in the same direction. Off Point Barrow the flood comes from the west, and the semi-diurnal range, which averages only 0·4 foot, is very much less than that observed at Bennett island (2 feet). If there were no land in the neighbourhood of the pole, the tide, which comes almost entirely from the Atlantic through the Greenland sea, would reach the one point as easily as the other, and there would be no reason for this discrepancy. In the Arctic archipelago, too, there are indications that the access of the tide from the north is not altogether unrestricted. Mr. Harris gives a sketch-map showing the outline of the northern land as he supposes it to exist. It is placed mainly on the American side of the pole, and its area approaches that of Greenland, two of its sides being roughly parallel to the drift of the *Fram* and *Jeannette* respectively, while a southward prolongation is supposed to closely approach Banks Land, thus accounting for the failure of the ice in the Beaufort sea to find an egress eastwards. The paper concludes with a reference to surmises that have been made by voyagers of the existence of land in the unknown northern area, and to the report of the sighting of land north of Alaska by Captain Keenan in the seventies.

Ice in the Arctic Seas in 1903.—The annual of the Danish Meteorological Institute for 1903 gives charts showing the state of the ice in the Arctic seas throughout the months from April to August inclusive, 1903. The data concern chiefly the seas to the north of Europe, round the coast of Greenland and the north-east coasts of North America, and the Bering straits. The report, in summary, shows a normal drift of polar ice into the temperate seas, but an unusual number of icebergs carried by the Labrador current. In Barents sea only the waters round Bear island were free of ice throughout the summer. The passage north of Novaya Zemlya and the approach to Franz Josef Land and north-east Spitzbergen were blocked most of the summer. To the end of August polar ice was met between South cape and Horne sound. During the last days of August sailing vessels had no difficulty in navigating north of Seven islands, and thence all along the north-west and west coast of Spitzbergen there was open water throughout September. Along the east coast of Greenland the winter ice lay unbroken during the first half of August. The coasts of Iceland were free of ice throughout the year, save only for a short period in April and June in Skagastrand bay. Throughout the spring and summer of 1903 there was a heavier drift of icebergs than had been known for years before along the coasts of Labrador and Newfoundland, and as late as November an iceberg was seen at Newfoundland bank. An isolated floe was observed in August at 37¾° N. and 71½° W. In Hudson strait icebergs were rather numerous, and floes somewhat more numerous than usual till the beginning of August. In Bering sea the eastern and the western passages both became available in the beginning of June, the strait being reached by both routes about June 20. The northward drift of ice in the strait ceased in the first half of July.

GENERAL.

The Population of the Earth.—In the latest issue of "Die Bevölkerung der Erde" (*Pet. Mitt.*, Ergänzungsheft 146) Prof. Supan completes his survey of the population of the world about the beginning of the twentieth century by summarizing the results of recent censuses in Europe and Australia, afterwards giving a general table showing his estimate of the population of each of the continents, and of the aggregate for the whole world. The results are as follows:—

	Total population.	Per sq. mile.
Europe	392,264,000	104
Asia	819,556,000	46·6
Africa	140,700,000	13
Australia and Polynesia	6,483,000	2
North America	105,714,000	13
South America	38,482,000	5
Polar Lands	91,000	—
Total	1,503,300,000	26

CORRESPONDENCE.

Himalayan Nomenclature.

Some months ago I was able to report to your readers that His Excellency the Viceroy of India, acting on a suggestion I had ventured, had succeeded in obtaining permission from the Nepalese Government for an English survey officer to proceed to Katmandu in order to identify the peaks visible from the heights in the neighbourhood of that city, and, further, to ascertain what names, if any, were given to them respectively by the natives of Central Nepal. The particular objects of this inquiry [illegible] to discover whether (1) Peak XV. of the Survey, the highest measured mountain in the world, was visible from this quarter; (2) if visible, whether it had been accurately identified by the German travellers Dr. Schlagintweit and Dr. Boeck; and (3) to what summit or summits, if any, the name Gaurisankar was locally attached.

For the past controversy on these matters I must refer your readers to the list below.*

The results of the present inquiry have been as follows.† Peak XV. has been successfully identified and measured by Captain Wood from two heights near Katmandu. The late Surveyor-General, General Walker, and Colonel Waddell were therefore in error in maintaining that from this quarter it was not visible. The peak was seen, as I had predicted it would be, as a comparatively inconspicuous object over a gap in the nearer mountains.‡ The inquiry has further proved that both H. Schlagintweit and Dr. Boeck were wrong in their identification of it. (Schlagintweit's XV. is really XX., Boeck's is XXIV., of the Survey.) I was wrong, therefore, in surmising that Boeck's XV. might be identified with XVIII., and in the consequent suggestion I made with respect to the position of Peak XV. in the panorama.

With regard to nomenclature, I must quote Captain Wood textually. "As regards the naming of the various peaks, I could discover nothing. The name Gaurisankar appears to be one given (by the nobles at Katmandu only) to the two highest peaks of the group which is the only conspicuous one seen from the city (the one marked as Gaurisankar on Schlagintweit's panorama is Peak XX.), and I very much doubt if they could recognize it if seen from a slightly different point of view. At least the officer His Excellency Maharaja Chandra Shamsher sent up to Kaulia to point out this peak to me failed to recognize it, and said it was not visible from there; and even after I had pointed out the peak to him, he said it was not Gaurisankar, but a peak something like it. Every lower-class native of the valley I asked did not know the peak by that or any other name, nor did they appear to give names to any of the snows at all. At Kaulia and at Mahadeo Pokra I had several —about ten in all—hillmen brought to me who were supposed to know the names of the hills, and every one, without exception, gave different names to the same peaks, and none called the peak known in the valley as Gaurisankar by that name. Very nearly every other peak visible was pointed out as Gaurisankar when asked; but with the exception of two men, both at Kaulia, none gave the name Gaurisankar to any peak until they were asked which was Gaurisankar. My method of questioning was to lay a straight stick on the plane-table, and tell them to point it in succession to the hills whose names they knew. At first I took down the names they gave; but as each gave a different one, I did not think any reliance could be put in them, and discontinued doing so. The two men mentioned above gave the name Gaurisankar, one to Peak XXIV. and the other to Peak XXVIII. Peak XXIV. is undoubtedly the one reproduced in the March *Journal* of the R.G.S. of 1903 from Dr. Boeck's work, and identified by Mr. Freshfield as Peak XVIII."

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* *Alpine Journal*, vol. xii. p. 438; vol. xxi. pp. 33, 317; vol. xxii. p. 56.
Proceedings of R.G.S. (N.S.), vol. viii. pp. 88, 177, 257; xiii. p. 108.
Geographical Journal, vol. xxi. p. 294; xxiii. p. 89.
Petermanns Mitteilungen, vol. xxxiv. pt. 2; vol. xlvii. pt. 1, pt. 12; vol. xlviii. pt. 1.
'A Few Lines on Mount Everest.' By Colonel H. C. B Tanner. Calcutta: 1890.
'Round Kangchenjunga,' p. 199, and Appendix. By Douglas W. Freshfield.
'Among the Himalayas,' by L. A. Waddell, p. 345.
'Durch Indien in Verschlossenen Land Nepal,' Dr. K. Boeck, p. 314.

† 'Report on the Identification and Nomenclature of the Himalayan Peaks as seen from Katmandu, Nepal.' By Captain H. Wood, R.E. With Preface by Colonel St. G. Gore, C.S.I., R.E. Calcutta: 1904. 3s.

‡ *Geographical Journal*, vol. xxiii. p. 89: "It will probably be found that the great peak, if visible at all, is far from conspicuous, and only recognizable—like the Finsteraarhorn from Grindelwald"—I had better have written from Milan—"to those who know where to look for it."

With this statement before my eyes, I can only express my amazement that the late Surveyor-General, Colonel Gore, should have commented on it in the following terms: "The whole evidence collected by Captain Wood is quite against the theory that Gaurisankar is a name given to the mountain mass of which Peak XX., which is the prominent point, is only one peak." As I read it, what Captain Wood's evidence proves is that the "nobles of Katmandu" call the snow summits they can see from the capital indifferently Gaurisankar, and that the hillmen are, when asked, ready to give that name to any peak visible.

Colonel Gore goes on, "There now remains the further question whether Peak XV. (Everest) can be called a peak of the group of which Peak XX. (Gaurisankar) is the most conspicuous as seen from Katmandu or its neighbourhood." "Everest," he writes, "which with Peak XIII. (Makalu) forms a separate group, stands 36 miles to the east of Peak XX., but separated from it by the upper end of the Dudh Kosi valley. The two groups are joined by a ridge running round to the north, over which the road passes by the Pangu-a" (la?) "from the Dudh Kosi valley to Dingri; but to call these groups one and the same is to my mind quite untenable." Captain Wood is, on this point, even more emphatic. "Everest . . . standing as it does quite apart from and a long way behind the main range, to call it a peak of the Gaurisankar group is absurd."

Colonel Gore has omitted to state that the so-called "road" in question is a glacier pass of over 20,000 feet, described by the Pundit who crossed it as one of great difficulty. It is, therefore, according to the principles used hitherto in the definition of Alpine groups, no proper boundary for a group. Nor, with all due deference to Captain Wood, can I see anything absurd in giving to a Himalayan group an extension only equal to that of the Bernese Oberland from the Gemmi to the Grimsel.

But I desire to be perfectly fair, and I most readily admit that to take a name which is often loosely applied, but which when specifically applied appears, as a rule, to be given to a knot, or one of a knot, of summits at one end of a group, and to fasten it on a peak 36 miles off at the other end of the group, seems at first sight a strong proceeding. Still, had the surveyors done this, they would have had the precedent of the early map-makers of Savoy, who, until nearer approach revealed the name of Mont Blanc, were content to use the generic term 'la montagne maudite,' which was often affixed by the Genevese to the Buet, for all the snows south and north of the Chamonix valley. If they did not feel justified in doing this, the surveyors might surely have waited. To call the highest mountain in the world after one of its late chiefs may seem natural to a Department, but it will hardly persuade—it has not succeeded in persuading—the world to share its view.

The question, which from the first was one mainly of taste, has in India now become partly one of feeling. It is a question on which people are likely to hold, and are justified in maintaining, different opinions. But the circumstances have changed since 1856—and even since 1886—and it seems to me no longer necessary to prolong the controversy, for the question has become an academical one. A local Tibetan name, Chomo-kankar, "The Lord of Snows," has been provided for Peak XV. on excellent native authority, confirmed by Colonel Waddell. By this the highest mountain, which stands on the frontier of Tibet, should in my opinion henceforth be designated by geographers.

I do not wish to lengthen this note by personal matter beyond what may be absolutely needful, but I cannot pass by without correction one or two statements in the recent Report. Colonel Gore observes that I allege the point of my argument to be "whether the 29,002-feet peak is among the snows visible from Kakani and known as Gaurisankar." He goes on, "This to my mind begs the question." If he will once more consider the matter, he will see, I am sure, that such an inquiry was a necessary preliminary to any profitable discussion of the main question, whether the name Gaurisankar could be legitimately affixed to Peak XV. That question had been shelved on the erroneous assertion made by a late Surveyor-General, and repeated by Colonel Waddell, that Peak XV. was invisible from near Katmandu.

Captain Wood on his part has imperfectly catalogued and incorrectly summarized (pp. 2, 3, near top) my contributions to the discussion; moreover, my attitude throughout is misrepresented. I have desired not to endorse, but to investigate, the identifications of the German travellers. In 'Round Kangchenjunga' I expressly said, "I am not prepared to treat (Dr. Boeck's) identification as satisfactorily established." I have never treated Schlagintweit's identification as established, and Captain Wood, when he states the contrary, on the authority of Schlagintweit's brother, Dr. E. Schlagintweit, has been misled. What I wrote in 1886 was—

"I am very ready to allow that General Walker has shown that the Schlagintweits' identification requires confirmation. Both Mr. Hodgson and the Schlagintweits may prove to be altogether wrong."

Finally, I must quote textually the following sentence of Captain Wood's: "Sir A. Waugh proposed first to the Government of India and then to the Royal Geographical Society in London to give to this peak the name of his predecessor in office, because, though he had always scrupulously adhered to the rule of assigning to every geographical object its true local or native appellation, the Survey officers had not been able to discover, nor were they likely to be able to do so, any local name, and that as it was probably the highest mountain in the world, he had decided to name it after his late chief and to show that it was the peak alone that was so named and not the range he prefixed the word 'Mont,' and not Mount." *

Once more, it seems, I must repeat what ought to be common knowledge, that neither in Latin nor in French, nor in the local usage of the Alps has Mons or Mont any significance beyond that of our English Mount, such as is here alleged. Has Captain Wood never heard of the Mont Cenis, the Mont St. Gotthard, and the Mont d'Or? I have shown elsewhere † that Sir A. Waugh's use of "Mont" was probably a slip of the pen or the printer, and was not followed by contemporary authorities.

DOUGLAS W. FRESHFIELD.

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* I leave the punctuation as in the original.

† *Petermanns Mitteilungen*, vol. xlviii.; *Alpine Journal*, vol. xxi.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Col. = Colonies.
Com. = Commerce.
C. R. = Comptes Rendus.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
Jb. = Jahrbuch.
k. u. k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. (mém.) = Memoirs, Mémoires.
Met. (mét.) = Meteorological, etc.
P. = Proceedings.
R. = Royal.
Rev. (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Alps. **Conway and McCormick.**

The Alps described by W. Martin Conway. Painted by A. D. McCormick. London: A. & C. Black, 1904. Size 9 × 6½, pp. x. and 294. *Illustrations. Price 20s. net. Presented by the Publishers.*

Sir Martin Conway's sketches are descriptive rather of types of Alpine and other mountain scenery than of individual scenes, and their instructiveness is thereby much enhanced. Peaks, passes, glaciers, Alpine pastures, are in turn dealt with, and there are chapters on "How to see Mountains," "How Mountains are made," "The Human Interest," etc. The illustrations are in Mr. McCormick's usual charming style.

Alps. **Schulz.**

Die Wandlungen des Klimas, der Flora, der Fauna und der Bevölkerung der Alpen und ihrer Umgebung vom Beginne der letzten Eiszeit bis zur jüngeren Steinzeit. Von Dr. A. Schulz. (Sonderabdruck aus der "Zeitschrift für Naturwissenschaften," Bd. 77.) Stuttgart: E. Schweizerbart, 1904. Size 9 × 6, pp. 41–70.

Alps. **Whymper.**

The Valley of Zermatt and the Matterhorn. A Guide by Edward Whymper. 8th edit. London: John Murray, 1904. Size 7½ × 5, pp. xiv. and 224. *Maps and Illustrations. Price 3s. net. Presented by the Author.*

Alps—Chamonix. **Whymper.**

Chamonix and the range of Mont Blanc. A Guide by Edward Whymper. 9th edit. London: John Murray, 1904. Size 7½ × 5, pp. xiv. and 206. *Maps and Illustrations. Price 3s. net. Presented by the Author.*

Alps—Glaciation. **Schulz.**

Das Schicksal der Alpen-Vergletscherung nach dem Höhepunkte der letzten Eiszeit. Von A. Schulz. (Separat-Abdruck aus dem Centralblatt für Mineralogie, Geologie und Palæontologie, 1904. S. 266–275.) Stuttgart: E. Schweizerbart, 1904. Size 9 × 6. *Presented by the Author.*

Alps—Historical. **Coolidge.**

Josias Simler et les Origines de l'Alpinisme jusqu' en 1600. Par W. A. B. Coolidge. Grenoble: [A. Gratier & J. Rey], 1904. Size 10½ × 7, pp. xxii., cxcii., 308, 328, and 100. *Map and Illustrations. Price 25 fr. Presented by the Publishers.*

Probably the most complete account yet written of the origins of Alpine climbing.

Austria—Meteorology. ——

Jahrbücher der K.K. Central-Anstalt für Meteorologie und Erdmagnetismus. Jahrgang 1902. N.F. XXXIX. Band. Wien: W. Braumüller, 1904. Size 12 × 9½, pp. xxxii., 132, 154, 32, and 24. *Presented by the K.K. Central-Anstalt für Meteorologie, etc.*

Austria-Hungary. *Jahrb. Ungar. Karpatenv.* **31** (1904): 1-17. **Hajnóci.**

Die natürlichen Verhältnisse (und der Grubenbau) des Zipser Erzgebirges. Von Dr. J. R. Hajnóci. (Erster Artikel.)

Austria-Hungary—Transylvania. *C. Rd.* **138** (1904): 1440-1442. **Martonne.**

Sur la plate-forme des hauts sommets des Alpes de Transylvanie. Note de Martonne.

Balkan Peninsula. **Baldacci.**

B.S.G. Italiana **4** (1903): 457-498, 634-645, 850-862, 930-943; **5** (1904): 141-146, 236-259, 299-315.

Nel paese del Cem. Viaggi di esplorazione nel Montenegro orientale e sulle Alpi Albanesi. Por Antonio Baldacci. *With Illustrations.*

Belgium—Flanders. *Mém. S. Belge Géologie* **18** (1904): 115-124. **Cornet.**

Sur la signification morphologique des collines des Flandres. Par J. Cornet.

Belgium—River-system. *B.S. Belge Géologie* **18** (1904): Proc.-Verb., 98-102. **Greindl.**

Quelques objections théoriques à l'hypothèse d'une superposition du réseau hydrographique de la Belgique à un réseau de failles préexistant. Par le capitaine Baron Greindl.

Faroes and Iceland. *J. Anthrop. I.* **33** (1903): 246-258. **Annandale.**

The Survival of Primitive Implements, Materials, and Methods in the Faroes and South Iceland. By Nelson Annandale. *With Plate.*

France—Brittany. *Travaux Sc. Université Rennes* **2** (1903): 333-348. **Martonne.**

Le développement des côtes bretonnes et leur étude morphologique. Par E. de Martonne.

France—Loire. *C. Rd.* **138** (1904): 1060-1062. **Welsch.**

Sur les failles et les ondulations des couches secondaires et tertiaires dans la vallée inférieure du Loire. Note de J. Welsch.

France—Map. *Ann. G.* **13** (1904): 113-120. **De la Blache.**

La carte de France au 50,000. Par P. Vidal de la Blache. *With Map.*

France—Marseilles. *B.S.G. Marseille* **27** (1903): 349-377. **Barré.**

Le Développement économique de Marseille de 1885 à 1900. Par H. Barré.

France—Montluçon. *Ann. G.* **13** (1904): 121-137. **Vacher.**

Montluçon: Essai de géographie urbaine. Par A. Vacher. *With Illustrations.*

France—Quarries. *The Quarry* **9** (1904): 265-267. ——

The Ancient Stone Quarries beneath Paris. *With Plans.*

France—Savoie. **Corcelle.**

J. Corcelle. Les Routes et les Vallées de la Savoie. Chambéry: Librairie Perrin, 1904. Size 9 × 6, pp. 122. *Illustrations. Presented by the Author.*

France—Vendée. *Rev. G.* **28** (1904): 211-216. **Pawlowski.**

Le bocage vendéen; Mervent. Par A. Pawlowski. *With Illustrations.*

Germany. *Forsch. deutsch. Landes- u. Volkskunde* **15** (1904): 296-346. **Wagner.**

Orometrie des Ostfälischen Hügellandes links der Leine. Von Dr. H. Wagner. *With Map.*

Germany—Canal. **Rose.**

Projected Rhine-Neckar-Danube Ship Canal. Foreign Office, Miscellaneous, No. 613, 1904. Size 10 × 6½, pp. 14. *Map. Price 3d.*

See note in the Monthly Record (p. 345).

Germany—Odenwald. **Jaeger.**

Forschungen deutsch. Landes- u. Volkskunde **15** (1904): 237-289.

Ueber Oberflächengestaltung im Odenwald. Von Dr. Fritz Jaeger. *Map.*

Iceland. *Globus* **85** (1904): 258-260. **Lehmann-Filhés.**

Die Waldfrage in Island. Von M. Lehmann-Filhés. *With Illustration.*

On the possibility of extending the growth of trees in Iceland (see *ante*, p. 346).

Italy—Sicily. **Jackson.**
Sicily. By F. H. Jackson. London: Methuen & Co., 1904. Size 6½ × 4, pp. xii. and 254. *Maps and Illustrations. Price 3s. Presented by the Publishers.*

Lake of Geneva. **Forel.**
F. A. Forel. Le Léman: Monographie limnologique. Tome Troisième. Deuxième livraison. Lausanne: F. Rouge & Cie, 1904. Size 10 × 6½, pp. 409-716. *Maps and Illustrations.*

This, the concluding section of M. Forel's great work, treats of the historical and economic relations of the lake.

Sweden—Frozen Soil. *Ymer* 24 (1904): 87-93. **Hamberg.**
Till frågan om förekomsten af alltid frusen mark i Sverige. Af Axel Hamberg.

Discusses the question of the existence of permanently frozen soil in Sweden.

Sweden—Upsala University. ——
Handlingar angående lediga E. O. Professors embetet i Geografi vid Upsala Universitet. Upsala, 1904. Size 8½ × 5½, pp. 128.

On the proceedings for the election of a professor of geography at Upsala University, resulting in the recommendation of Dr. Ahlenius for the post.

Switzerland—Communications. *Quest. Diplom. et Colon.* 7 (1903): 538-544. **Loiseau.**
Le Percement des Alpes Bernoises. Trusts et Concurrence Internationale.

United Kingdom. **Hull.**
On the Age of the last Uprise of the British Isles. By Prof. Edward Hull. Being a paper read before the Victoria Institute. Size 8½ × 5½, pp. 22. *Map. Presented by the Author.*

United Kingdom—England. **Woolacott**
The Geological History of the Tyne, Wear, and Associated Streams. By D. Woolacott. (Excerpt from *Proc. Durham Philosophical Soc.*, vol. ii. pt. 3.) Newcastle-upon-Tyne: A. Reid & Co., 1903. *Presented by the Author.*

United Kingdom—Ireland. **[Murray.]**
[Murray's] Handbook for Travellers in Ireland. Sixth edition, revised and edited by John Cooke. London: E. Stanford, 1902. With Index and Directory for 1904. Size 7 × 5, pp. x., 46, and 558. *Maps and Plans. Price 9s. Presented by the Publisher.*

United Kingdom—Isle of Wight. **Clinch.**
The Isle of Wight. By G. Clinch. Illustrated by F. D. Bedford. London: Methuen & Co., 1904. Size 6½ × 4, pp. xii. and 184. *Maps and Illustrations. Price 3s. Presented by the Publishers.*

United Kingdom—London. *Scottish G. Mag.* 20 (1904): 196-202. **Richardson.**
The Port of London. (A French View.) By Ralph Richardson. *With Maps.*

United Kingdom—Scotland. **Geddes.**
A Study in City Development. Park, Gardens, and Culture-Institutes. A Report to the Carnegie Dunfermline Trust. By Patrick Geddes. Dunfermline, 1904. Size 11½ × 8½, pp. 228. *Plans and Illustrations. Presented by the Author.* [To be reviewed.]

United Kingdom—Scotland. **[Murray.]**
[Murray's] Handbook for Travellers in Scotland. Edited by Scott Moncrieff Penney. Eighth edition. London: E. Stanford, 1903. Size 7½ × 5, pp. liv. and 510. *Maps and Plans. Price 10s. 6d. Presented by the Publisher.*

United Kingdom—Scotland—Place-names. **Mackinlay.**
Influence of the Pre-Reformation Church on Scottish Place-names. By J. M. Mackinlay. Edinburgh and London: W. Blackwood & Sons, 1904. Size 9 × 6, pp. xx. and 464. *Price 12s. 6d.*

United Kingdom—Wales. **Baddeley and Ward.**
Thorough Guide Series, North Wales (Part ii.). Llangollen, Bala, Dolgelley, Barmouth, Oswestry, Shrewsbury, Welshpool, Llanidloes, Machynlleth, and Aberystwyth Sections. By J. B. Baddeley and C. S. Ward. Sixth Edition. London: Dulau & Co., 1904. Size 6½ × 4½, pp. xvi. and 158. *Maps, Plans, and Panorama. Price 2s. 6d. net. Presented by the Publishers.*

The principal improvement in this edition is the provision, as in others of the series, of coloured contoured section-maps.

United Kingdom—Woodlands. *J. R. Agric. S.* 64 (1903): 16–49. **Curtis.**
The Management and Planting of British Woodlands. By Charles E. Curtis.

United Kingdom—Yorkshire. **Fox-Strangways.**
Memoirs of the Geological Survey. England and Wales. The Geology of the Oolitic and Cretaceous Rocks south of Scarborough. (Explanation of Sheets 54 and 55, New Series; 95 S.E. and 95 S.W., Old Series.) By C. Fox-Strangways. Second Edition. London: E. Stanford, 1904. Size 10 × 6½, pp. viii. and 120. *Map and Illustrations. Price* 4*s.* 6*d. Presented by the Director of the Geological Survey and Museum.*

United Kingdom—Yorkshire. **Morris.**
The North Riding of Yorkshire. By J. E. Morris. Illustrated by R. J. S. Bertram. London: Methuen & Co., 1904. Size 6½ × 4, pp. xiv. and 432. *Maps and Illustrations. Price* 3*s. Presented by the Publishers.*

ASIA.

Arabia. *C. Rd.* 138 (1904): 1445–1447. **Houdas.**
Sur une éruption volcanique qui a eu lieu en Arabie, près de la ville de Médine, le 30 juin 1256. Note de M. Houdas.

Asia. *Popular Sci. Monthly* 65 (1904): 68–73. **Kropotkin.**
The Geology and Geo-botany of Asia. By Prince P. Kropotkin.

Caspian Sea. *Petermanns M.* 50 (1904): 126–128. **Knipowitsch.**
Hydrobiologische Untersuchungen des Kaspischen Meeres. Reiseberichte von N. Knipowitsch.

Central Asia—Tian Shan. *Appalachia* 10 (1904): 277–284. **Davis.**
A Flat-topped Range in the Tian-Shan. By W. M. Davis.

Ceylon. **Ferguson.**
Ceylon in 1903, describing the Progress of the Island since 1803, its present Agricultural and Commercial Enterprises, and its unequalled Attractions to Visitors. By John Ferguson, C.M.G. Colombo: A. M. & J. Ferguson, 1903. Size 8 × 5½, pp. viii., 40, 154, and clxxxvi. *Map and Illustrations. Presented by the Author.*

China. *Petermanns M.* 50 (1904): 131–140. **Anz.**
Eine Winterreise durch Schantung und das nördliche Kiang-su. Von W. Anz. *With Map.*

China. *Contemporary Rev.* 85 (1904): 871–877. **Boulger.**
The Shanghai-Nanking Railway. By D. C. Boulger.

China. *La G., B.S.G. Paris* 9 (1904): 493–495. **Lemoine.**
Voyage au Yun-nan et aux régions tibétaines. But de voyage, par M. le lieutenant Grillières. *With Map.*

Lieut. Grillières did some survey work in the region of the upper Yangtse, Mekong, and Salwen.

China. *Asien* 3 (1904): 55–59. **Pflughöft.**
Tsinanfu, die Hauptstadt von Schantung. Von H. Pflughöft. *With Plan.*

China. *La G., B.S.G. Paris* 9 (1904): 461–464. **Servagnat and Aïtoff.**
Les déplacements du Houn-Ho inférieur. Par D. Aïtoff. *With Map.*

Based on a study by Lieut. Servagnat in the *Revue des Troupes Coloniales.*

China. ———
Commercial China in 1904. Area, Population, Production, Railways, Telegraphs, and Transportation Routes, and Foreign Commerce and Commerce of United States with China. [From the *Monthly Summary of Commerce and Finance* for January, 1904.] Washington, 1904. Size 12 × 9½, pp. 2325–2446. *Map.*

China—Mongolia. **Kidston.**
China, No. 3 (1904). Despatch from His Majesty's Minister at Peking, enclosing a Report by Mr. George J. Kidston on a Journey in Mongolia. London: Eyre & Spottiswoode, 1904. Size 13 × 8½, pp. 26. *Map and Illustrations. Price* 6*d.*

The route lay almost entirely to the west of Mr. Campbell's.

China—Trade. ———
China. Imperial Maritime Customs. 1.—Statistical Series: Nos. 3 and 4. Returns

of Trade and Trade Reports for the year 1903. Part i. Report on the Trade of China, and Abstract of Statistics. Shanghai: Kelly & Walsh; Londen: P. S. King & Son. 1904. Size 11 × 9, pp. 40.

China—Treaties. ——

Treaties between the Empire of China and Foreign Powers, together with regulations for the Conduct of Foreign Trade, Conventions, Agreements, Regulations, etc., etc., the Peace Protocol of 1901, and the Commercial Treaty of 1902. Fourth Edition. Shanghai: *North-China Herald* Office, 1902. Size 9½ × 6½, pp. 332.

China Sea—Sailing Directions. ——

The China Sea Directory, vol iii., or Sailing Directions for the Coast of China from Hongkong and the Chu Kiang to the Yalu Kiang. Fourth Edition. London: J. D. Potter, 1904. Size 9½ × 6, pp. xxviii. and 716. *Index, Map, and Diagrams. Price* 4*s.* 6*d. Presented by the Admiralty.*

Chinese Empire—Mongolia. *Petermanns M.*, **50** (1904): 152–153. **Woeikow.**

Peretoltschines Erforschung des Kossogol-Sees. Von Prof. Dr. A. Woeikow.

Chinese Empire—Tibet. **Grenard.**

Mission Dutreuil de Rhins dans la Haute Asie. Le Tibet, le pays et les habitants. Par F. Grenard. Paris: A Colin, 1904. Size 7½ × 5, pp. iv. and 388. *Map. Price* 5*fr. Presented by the Publisher.*

A useful general account of Tibet and its inhabitants, with a sketch of the history of travel within its borders.

Chinese Turkestan. **Stein.**

Sand-buried Ruins of Khotan. Personal Narrative of a Journey of Archæological and Geographical Exploration in Chinese Turkestan. By M. Aurel Stein. Cheaper Edition. London: Hurst & Blackett, 1904. Size 9 × 6, pp. xl. and 504. *Maps and Illustrations. Price* 7*s.* 6*d. net. Presented by the Publishers.*

In spite of its moderate price, this new edition of Dr. Stein's work (*Journal*, vol. xxii. p. 449) is excellently got up, and should find many readers.

Eastern Asia. **Hatch.**

Far Eastern Impressions. By E. F. G. Hatch, M.P., Japan, Korea, China. London: Hutchinson; & Co., 1904. Size 8 × 5½, pp. xiv. and 258. *Maps and Illustrations. Price* 6*s. net. Presented by the Publishers.*

Embodies the results of studies and inquiries made during a tour some years ago, corrected by later knowledge. The book will be read with interest in connection with the present war.

Malay Archipelago—Borneo. **Nieuwenhuis.**

Quer durch Borneo. Ergebnisse seiner Reisin in den Jahren 1894, 1896–97 und 1898-1900. Von Dr. A. W. Nieuwenhuis. Unter Mitarbeit von Dr. M. Nieuwenhuis—von Uxküll-Güldenbandt. Erster Teil. Leiden: E. J. Brill, 1904. Size 11 × 8, pp. xvi. and 494. *Maps and Plates. Price* 21*s.*

To be reviewed.

Russia—Siberia—Semiretchinsk. **Sapozhnikoff.**
Iz. Imp. Russian G.S. **39** (1903): 273–294.

Preliminary Report of the Semiretchinsk Scientific Expedition. By Prof. V. V. Sapozhnikoff. [In Russian.]

Russia—Siberia—Yeneseisk. *Zap. Imp. Russian G.S., General G.* **34**, No. 2. **Kriloff.**

Notes of a Journey in the Country of the Uriankhais. By P. Kriloff. Size 10 × 6½, pp. 167. St. Petersburg, 1903. *Maps and Profiles.* [In Russian.]

The country dealt with lies south-east of Minusinsk.

Russia—Transcaucasia—Georgian Language. **Dirr.**

Theoretisch-praktische Grammatik der modernen georgischen (grusinischen) Sprache, mit Uebungsstücken, einem Lesebuch, einer Schrifttafel und einer Karte. Von A. Dirr. Wien und Leipzig: A. Hartleben, [*not dated*]. Size 7 × 4½, pp. xiv. and 170. *Price* 2 *m. Presented by the Publisher.*

Russian Central Asia—Sir Darya. **Pyzirevsky.**
Iz. Imp. Russian G.S. **38** (1902): 503–545.

The characteristics and the Navigation of the Sir Darya. By N. P. Pyzirevsky. *Map.* [In Russian.]

Tibet. *Contemporary Rev.* **85** (1904): 640–648. **Ular.**

The Solution of the Tibetan Problem. By A. Ular.

Tibet. *Mem. S.G. Italiana* 10 (1904): pp. lxiv. and 402. **Puini.**

Carlo Puini. Il Tibet (Geografia, Storia, Religione, Costumi) secondo la relazione del Viaggio del P. Ippolito Desideri (1715–1721).

This work of the well-known missionary Desideri is now printed for the first time. The author, by his lengthened stay in Lhasa, gained a fuller insight than most of the early missionaries into the religion, manners, and customs of the Tibetans, which he here describes in detail.

Tibet—Lhasa. **Kawaguchi.**

The Latest News from Lhasa. A Narrative of Personal Adventure. By the Rev. Ekai Kawaguchi. Introduction by Miss Scidmore. (From the *Century Magazine.*) Size 9½ × 7, pp. 383–393. *With Portrait.*

Tibet—Lhasa. *Globus* 85 (1904): 269–274. **Wegener.**

Lhassa. Von Dr. G. Wegener. *With Plan. Also Separate Copy, presented by the Author.*

Turkey and Persian Gulf. *National G. Mag.* 15 (1904): 139–151. **Fairchild.**

Travels in Arabia and along the Persian Gulf. By D. G. Fairchild. *With Illustrations.*

The writer was sent by the U.S. Department of Agriculture to report on agricultural possibilities in Babylonia, and to secure the best varieties of Persian and Arabian dates for cultivation in Arizona.

AFRICA.

Africa. **Dehérain.**

Henri Dehérain. Études sur l'Afrique. Soudan Oriental, Éthiopie, Afrique Équatoriale, Afrique du Sud. Paris: Hachette et Cie., 1904. Size 7½ × 5, pp. vi. and 302. *Maps. Presented by the Publishers.*

A collection of articles which have appeared in periodical publications on various subjects connected with the exploration and political conquest of Africa, on which the author is a well-known authority.

Africa. *Nineteenth Century* 55 (1904): 937–946. **Johnston.**

The White Man's place in Africa. By Sir H. H. Johnston, G.C.M.G., etc.

The writer insists that, apart from certain healthy regions capable of colonization by whites, the greater part of tropical Africa must be regarded as a black man's country, in which the interests of the black man must be rated first.

Africa. **Weinthal.**

"Round Africa" by the D.O.A. Line. A Guide Book for Passengers to North, East, and South Africa. Compiled and edited by Leo Weinthal. London: A. Andrews, [1902]. Size 6½ × 5, pp. 392. *Maps and Illustrations. Presented by the Compiler.*

Africa—Swiss Explorers. **Schinz.**

Schweizerische Afrika-Reisende und der Anteil der Schweiz an der Erschliessung und Erforschung Afrikas überhaupt. Von Prof. Dr. H. Schinz. (Neujahrsblatt herausgegeben von der Naturforschenden Gesellschaft auf das Jahr 1904. 106 Stück.) Zürich. Size 11½ × 9, pp. 52. *Map.*

British Central Africa—Bemba Language. **Robertson.**

An Introductory Handbook to the Language of the Bemba People (Awemba). By W. G. R. London: the London Missionary Society, 1904. Size 7 × 4½, pp. xxii. and 546. *Presented by the Author.*

Ivory Coast—Languages. **Delafosse.**

Vocabulaires comparatifs de plus de 60 Langues ou Dialectes parlés à la Côte d'Ivoire et dans les régions limitrophes. Avec des Notes linguistiques et ethnologiques, une Bibliographie et une Carte. Par Maurice Delafosse. Paris: E. Leroux, 1904. Size 11½ × 7½, pp. iv. and 286.

Madagascar. **Grandidier.**

Collection des Ouvrages anciens concernant Madagascar publiée sous la direction de MM. A. Grandidier, C. Roux, C. Delhorbe, H. Froidevaux et G. Grandidier. Tome ii. Ouvrages ou extraits d'ouvrages français (jusqu'à 1630), portugais, hollandais, anglais, allemands, italiens, espagnols et latins relatifs à Madagascar (1613 à 1640). Par MM. A. Grandidier et G. Grandidier. Paris: Comité de Madagascar, 1904. Size 10 × 6½, pp. 560. *Maps and Illustrations.*

To be reviewed with vol. i.

Madagascar. **Matthews.**
Thirty Years in Madagascar. By the Rev. T. T. Matthews of the London Missionary Society. London: The Religious Tract Society, 1904. Size 8½ × 5½, pp. 384. *Map and Illustrations. Price 6s. Presented by the Publishers.*

An account of the progress of Protestant missions in Madagascar during the past thirty years, with a good deal of incidental reference to political and other events during that period.

Morocco. **Aubin.**
Eugène Aubin. Le Maroc d'aujourd'hui. Paris: A. Colin, 1904. Size 7½ × 5, pp. xii. and 500. *Maps and Plan. Price 5fr. Presented by the Publisher.*

The writer travelled in Morocco in 1902–03, and though he seems hardly to have left the beaten tracks, the evident pains which he took to make himself acquainted with the present condition of the country render the work of some interest.

Orange River Colony. *T. Geolog. S. South Africa* 6 (1904): 20–26. **Molengraaff.**
Remarks on the Vredefort Mountain-Land. By Dr. G. A. F. Molengraaff. *With Sketch-map and Section.*

Rhodesia. **Hall and Neal.**
The Ancient Ruins of Rhodesia (Monomotapæ Imperium). By R. N. Hall and W. G. Neal. Second Edition. London: Methuen & Co., 1904. Size 9 × 6, pp. xlviii. and 404. *Map, Plans, and Illustrations. Price 10s. 6d. net. Presented by the Publishers.*

In the absence of the authors in South Africa for the purpose of further research, this edition has been carefully revised by Prof. Keane.

Sahara. *Rev. G.* 28 (1904): 54–60. **Kerganof.**
Tableaux du Sahara: un Convoi au Tidikelt. Par Yves Kerganof. *Illustrations.*

South Africa. **Bryden.**
A History of South Africa from the First Settlement by the Dutch, 1652, to the Year 1903. By H. A. Bryden. London: W. Sands, 1904. Size 8 × 5, pp. viii. and 364. *Map. Presented by the Publisher.*

Though more of a compilation than a result of original research, this compact *résumé* of South African history will be useful to the general reader, for whom such detailed histories as Dr. Theal's are unsuitable.

South Africa. *T. Geolog. S. South Africa* 6 (1904): 16–19. **Corstorphine.**
Note on the Age of the Central South African Coalfield. By Dr. G. S. Corstorphine.

South Africa. *T. Geolog. S. South Africa* 6 (1904): 60–67. **Johnson.**
On the Discovery of Implement-bearing Deposits in the Neighbourhood of Johannesburg: their relative Age, and Bearing on the Question of the Antiquity of Man in South Africa. By J. P. Johnson. *With Plates.*

South Africa—Climate. *Z. Ges. Erdk. Berlin* (1904): 176–193. **Passarge.**
Die Klimatischen Verhältnisse Süd-Afrikas seit dem mittleren Mesozoicum. Von Dr. S. Passarge. *With Plates.*

South-West Africa—Frontier. *M. a. d. Deuts. Schutzgebieten* 17 (1904): 6–28. ——
Die deutsch-englische Grenzvermessung in Deutsch-Südwestafrika, 1898–1903. *Map.*
Geographische Koordinatentafel der Dreieckspunkte der deutsch-englischen Grenzvermessung.

Tunis. **Pervinquière.**
Étude géologique de la Tunisie Centrale. (Thèses présentées à la Faculté des Sciences de Paris pour obtenir le grade de Docteur ès Sciences Naturelles. Par L. Pervinquière.) Paris: F. R. de Rudeval, 1903. Size 12 × 9½, pp. 360. *Map and Illustrations.*

Victoria Nyanza. *Mouvement G.* 21 (1904): 61–64, 73–75. **Cornet.**
Le Victoria-Nyanza est-il un *Reliktensee*? Par J. Cornet.

Contests the theory that the African lakes are vestiges of a Jurassic sea.

Wadai. **Nachtigal.**
Renseign. Colon., Com. l'Afr. Franc. (1903): 49-72, 104-119, 135-146, 167-173, 180-197, 215-230, 247-255, 268-276.
Le Voyage de Nachtigal au Ouadaï, traduction par J. Van Vollenhoven. *With Map.*

Translation of the portion of Nachtigal's work 'Sahara und Sudan' relating to Wadai.

West Africa. *La G., B.S.G. Paris* 9 (1904): 257-267. **Hulot.**
Historique des missions Bénoué-Tchad. Par — Hulot.

NORTH AMERICA.

Alaska. *National G. Mag.* 15 (1904): 213-219. **Brooks.**
The Geography of Alaska. By A. H. Brooks. *With Map.*

The map is on the scale of 1 : 2,500,000 (about 40 miles to the inch), and embodies the results of recent surveys.

Alaska. **Cardot and others.**
Harriman Alaska Expedition, with co-operation of Washington Academy of Sciences, Alaska. Vol. v. Cryptogamic Botany. By J. Cardot, Clara E. Cummings, Alexander W. Evans, C. H. Peck, P. A. Saccardo, De Alton Saunders, I. Thériot, and William Trelease. New York: Doubleday, Page & Co., 1904. Size 10½ × 7½, pp. 424. *Plates. Price $5 net. Presented by the Publishers.*

A brief introduction outlines the general character of the cryptogamic flora, but the bulk of the volume is taken up with systematic descriptions of the collections.

Alaska. **Mendenhall.**
Reconnaissance from Fort Hamlin to Kotzebue Sound, Alaska, by way of Dall, Kanuti, Allen, and Kowak Rivers. By W. C. Mendenhall. (United States Geological Survey, Professional Paper, No. 10.) Washington, 1902. Size 11½ × 9, pp. 68. *Maps and Illustrations. Presented by the U.S. Geological Survey.*

Alaska—Boundary. **Davidson.**
The Alaska Boundary. George Davidson. San Francisco: Alaska Packers Association, 1903. Size 10½ × 7, pp. 236. *Portrait and Maps. Presented by the Author.*

An elaborate presentment of the United States view in the recent boundary dispute, written before the award was made. It is based on a thorough knowledge of the whole literature of the subject, and is a valuable contribution to historical geography.

Canada. **Lynch.**
Three Years in the Klondike. By J. Lynch. London: E. Arnold, 1904. Size 9½ × 6, pp. 280. *Map and Illustrations. Price 12s. 6d. net. Presented by the Publisher.*

Gives a vivid idea of life in the gold-fields of the far North-West. There are some good photographs and sketches of Yukon scenery, etc., including a striking general view of Dawson.

North America. **Russell.**
North America. By Israel C. Russell. London, etc.: H. Frowde, 1904. Size 9½ × 6½, pp. viii. and 436. *Maps and Illustrations. Price 7s. 6d. net. Presented by the Publisher.*

To be reviewed.

CENTRAL AND SOUTH AMERICA.

Andes. *Mém. S. Belge Géologie* 18 (1904): 79-105. **Ballore.**
Les Andes méridionales sismiques. Par F. de Montessus de Ballore. *With Map.*

Argentine Republic. **Carrasco.**
El Crecimiento de la Población de la República Argentina comparado con el de las principales naciones, 1890-1903. Trabajo presentado al segundo Congreso Médico Latino-Americano de Buenos Aires. Por G. Carrasco. Buenos Aires, 1904. Size 10½ × 7, pp. 14. *Diagrams. Presented by the Oficina Demográfica Argentina.*

Argentine Republic—Buenos Aires. *Petermanns M.* 50 (1904): 83–92, 112–117. **Hauthal.**
Beiträge zur Geologie der argentinischen Provinz Buenos Aires. Von Prof. Dr. R. Hauthal. *With Map and Illustrations.*

Argentine—Historical. **Mitre and Quevedo.**
Ulrich Schmídel. Viaje al Rio de la Plata (1534–1554). Notas Bibliográficas y Biográficas por Bartolomé Mitre. Prólogo, Traducción y Anotaciones por S. A. Lafone Quevedo. Buenos Aires: Cabaut y Cia., 1903. Size 9 × 6, pp. xvi. and 500. *Maps and Illustrations. Presented by Sr. Lafone Quevedo.*

See review, *ante.*

Bolivia. **Créqui-Montfort and Sénéchal de la Grange.**
B.S.G. Écononom. et Com. Paris 26 (1904): 76–84.
L'Exploration des Hauts-Plateaux boliviens. Mission de Créqui-Montfort et Sénéchal de la Grange. *With Map.*

Cf. note in Monthly Record for April, 1904 (p. 525).

Bolivia. *La G., B.S.G. Paris* 9 (1904): 409–430. **Neveu-Lemaire.**
Le Titicaca et le Poopo. Contribution à l'étude des lacs des hauts plateaux boliviens. Par Dr. M. Neveu-Lemaire. *With Map and Illustrations.*

Bolivia. ———
Sinopsis Estadistica y Geográfica de la Republica de Bolivia. Tomo iii. La Paz, 1904. Size 9 × 6, pp. 340.

Brazil—Acre. *Deutsch. Rundschau G.* 26 (1904): 354–362. ———
Aus dem Acre-Gebiet (Brasilien).

Brazil—Bahia. **Franca.**
Traffic of the State of Bahia. Justino da Silveira Franca. Bahia, 1904. Size 10½ × 8, pp. 26. *Map. Presented by Sr. A. J. de Souza Carneiro.*

Brazil—Bahia. ———
Secretaria da Agricultura, Viação, Industria e Obras Publicas do Estado da Bahia. Annexos ao Relatorio do Secretario da Agricultura, Miguel Calmon du Pin e Almeida, 1903. Bahia, 1904. Size 11 × 7½, pp. 110. *Maps. Presented by Sr. A. J. de Souza Carneiro.*

Reports on road and railway surveys.

Brazil—Stone Reefs. **Branner.**
B. Museum Comparative Zoology, Harvard College 44 (1904): pp. 286.
The Stone Reefs of Brazil, their Geological and Geographical relations, with a Chapter on the Coral Reefs. By J. C. Branner. *With Maps and Plates. Presented by Prof. A. Agassiz.* [To be reviewed.]

AUSTRALASIA AND PACIFIC ISLANDS.

Australasia—Climate. **Gregory.**
The Climate of Australasia in reference to its Control by the Southern Ocean. . . . By Prof. J. W. Gregory, D.SC. Melbourne, etc.: Whitcombe & Tombs, 1904. Size 7 × 5, pp. 96. *Diagrams. Price* 1*s.*

Australia. *Scottish G. Mag.* 20 (1904): 253–261. **Macdonald.**
The Opal Formations of Australia. By R. M. Macdonald. *With Illustrations.*

Central Australia. **Spencer and Gillen.**
The Northern Tribes of Central Australia. By B. Spencer and F. J. Gillen. London: Macmillan & Co., 1904. Size 9 × 6, pp. xxxvi. and 784. *Maps and Illustrations. Price* 21*s. net. Presented by the Publishers.*

Embodies the information collected by the well-known explorers of Central Australia relative to the social organization, ceremonies, and customs of the aborigines.

Ellice Islands—Funafuti. ———
The Atoll of Funafuti. Borings into a Coral Reef and the Results. Being the Report of the Coral Reef Committee of the Royal Society. London: Published by the Royal Society, Harrison & Sons, 1904. Size 12 × 9½. *Maps (in separate cover), Chart, and Illustrations. Presented by the Royal Society.* [See review, *ante.*]

New South Wales and Victoria. *Victorian G.J.* 20 (1902): 71–84. **Ogler.**
Original Official Boundary between New South Wales and Victoria. By S. C. H. Ogler. *Map.*

w Zealand. **Courte.**

Comte de Courte. La Nouvelle-Zélande. Préface de M. le Baron Hulot. Paris: Hachette et Cie., 1904. Size 10 × 6½, pp. 268. *Illustrations. Price* 12*fr. Presented by the Publishers.*

The author, who is (or has been) French Consul in New Zealand, gives a vivid scription of the natural scenery of New Zealand, and sketches the life of the people.

cific. *Victorian G.J.* 21 (1903): 85–98. **Macdonald.**

Mysteries of the Pacific. By A. C. Macdonald.

Mainly concerned with Easter island and Ponape, and their early inhabitants.

Pacific—French Islands. *S.G. l'Est* 24 (1903): 114-131; 257-280. **Lemire.**

L'Océanie Française. La France dans le Pacifique. Par Ch. Lemire.

Pacific—Quiros' Discoveries. *Victorian G.J.* 21 (1903): 121-125. **Collingridge.**

Report on the Identification of Queiroz' Discoveries in the Regions of his Tierra Austrialia del Espiritu Santo. By Geo. Collingridge.

Suggests that the exact site of Quiros' anchorage in the bay of St. Philip and St. James in Santo has become silted up.

POLAR REGIONS.

Antarctic. *C. Rd.* 139 (1904): 90-91. **Arçtowski.**

Sur la variabilité de la température dans les régions Antarctiques. Note de H. Arçtowski.

Antarctic. **Arçtowski.**

Y a-t-il Moyen d'arriver au Pole Sud en automobile. Par Henryk Arçtowski. Bruxelles, 1903. Size 10 × 6½, pp. 6. *Illustrations.* (Extr. du No. 11 (1903) du B. S. belge d'Astron.) *Presented by the Author.*

The author thinks it possible that a motor vehicle might be constructed, which should take the place of the sledges hitherto used for Antarctic journeys.

Antarctic. *National G. Mag.* 15 (1904): 220-221. **Balch.**

Termination Land. The Western end of the Antarctic continent discovered by the American Wilkes. By E. S. Balch.

The writer shows that the existence of Wilkes Land is confirmed by the work of the German Antarctic Expedition.

MATHEMATICAL GEOGRAPHY.

Astronomy. **Christie.**

Astrographic Catalogue 1900·0, Greenwich Section Dec. + 64° to 90°. From Photographs taken and measured at the Royal Observatory, Greenwich, under the direction of W. H. M. Christie, C.B., etc., Astronomer Royal. Vol. i. Measures of Rectangular Co-ordinates and Diameters of Star Images, Dec. + 64° to + 72°. Edinburgh, 1904. Size 13 × 10½, pp. lxiv. and 738. *Plates. Presented by the Astronomer Royal, Greenwich.*

Determination of Position. **Gelcich.**

Die astronomische Bestimmung der geographischen Koordinaten. Von E. Gelcich. (Die Erdkunde . . . herausgegeben von M. Klar, vii. Teil.) Leipzig und Wien: F. Deuticke, 1904. Size 10½ × 7, pp. x. and 126.

Geodesy. *Sitz. K.P.A.W. Berlin* (1904): 295-300. **Albrecht.**

Neue Bestimmung des geographischen Längenunterschiedes Potsdam-Greenwich. Von Prof. Dr. T. Albrecht.

Surveying. **Larminat.**

E. de Larminat. Topographie pratique de reconnaissance et d'exploration suivie de notions élémentaires pratiques de géodésie et d'astronomie de campagne. Paris: H. Charles-Lavauzelle, [not dated]. Size 9 × 6, pp. 344 and 12. *Illustrations. Price* 6*s.* 6*d.*

Surveying. **Mockler-Ferryman.**

Military Sketching and Reconnaissance. By Lieut.-Colonel A. F. Mockler-Ferryman. London: E. Stanford, 1903. Size 7½ × 5, pp. xii. and 202. *Illustrations. Price* 5*s. net. Presented by the Publisher.*

An excellent little book, giving clear and concise directions for reconnaissance work.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Climates. **Bertrand.**

Le Rythme des Climats. La Glaciation, la Panthermalité. Par J. Bertrand. (Extrait des Nos. 5–6 [1904] du *Bulletin de la Société belge d'Astronomie.*) Bruxelles: Société Belge d'Astronomie. Size 10 × 6½, pp. 48. *Maps and Diagrams. Presented by the Author.*

Geology—Bibliography. ———

International Catalogue of Scientific Literature. Second Annual Issue. H. Geology. London: Harrison & Sons, 1904. Size 8½ × 5½, pp. viii. and 256. *Price* 16*s*. 6*d*.

Geomorphology—Angle of slope. **Piwowar.**

Vierteljahrs. Naturforsch. Ges. Zürich 48 (1903): 335–359.

Ueber Maximalböschungen trockener Schüttkegel und Schutthalden. Von A. Piwowar.

Geomorphology—Terraces. **Popoff.**

Verh. Russ.-K. Mineralog. Ges. St. Petersburg 41 (1904): 55–64.

Zur Frage von der Entstehung terrassenähnlicher Abstufungen, an moränebedeckten Gebirgsanhängen, unter Inlandeis gewesener Gebiete. Von Boris Popoff.

Based on observations in Russian Lapland.

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Anthropogeography. *Petermanns M.* 50 (1904): 68–79, 92–95. **Friedrich.**

Wesen und geographische Verbreitung der "Raubwirtschaft." Von Dr. E. Friedrich. *Also separate copy, presented by the Author.*

Anthropology—Bibliography. ———

International Catalogue of Scientific Literature. Second Annual Issue. P. Physical Anthropology. London: Harrison & Sons, 1904. Size 8½ × 5½, pp. viii. and 300. *Price* 15*s*.

One of the most complete and comprehensive of the volumes of the International Catalogue, especially with regard to English publications.

Historical—Early Voyages. **Hakluyt.**

The Principal Navigations, Voyages, Traffiques, and Discoveries of the English Nation, etc. By Richard Hakluyt. Vols. v. and vi. Glasgow: J. MacLehose & Sons, 1904. Size 9 × 6, pp. (vol. v.) xvi. and 512; (vol. vi.) xvi. and 528. *Maps and Plates. Presented by the Publishers.*

The whole of these two volumes deal with voyages to the south and south-east. Like the former volumes, their value is enhanced by reproductions of early maps, plans, and portraits, among the most interesting being illustrations of ships of the period, from the 'Architectura Navalis' of J. Furttenbach; a sailing chart of the Mediterranean made by Jacobus Russus, of Messina, in 1564; an English sailing chart by T. Wood, of date 1592; the despatch from Sir F. Drake describing the burning of the Spanish ship in Cadiz Harbour, 1587; and William Borough's chart of the same operations.

Historical—Levant Company. **Rosedale.**

Queen Elizabeth and the Levant Company. A Diplomatic and Literary Episode of the Establishment of our Trade with Turkey. Edited with Twenty-six Facsimile Illustrations of Manuscripts and other Interesting Plates, from Manuscripts in His Majesty's Public Record Office, the Manuscript Department of the British Museum, and the Archives of Venice, etc. By the Rev. H. G. Rosedale, D.D. London: H. Frowde, 1904. Size 13½ × 9½, pp. xii. and 92. *Price* 10*s*. 6*d*. *net*. *Presented by the Royal Society of Literature.* [See review, *ante*.]

BIOGRAPHY.

Duchesne-Fournet. *Questions Dipl. et Colon.* 17 (1904): 822–827. **Lemoine.**

Jean Duchesne-Fournet. Par F. Lemoine.

This promising young French explorer (*Journal*, xxii. 213) died early in the present year.

Fea. **Gestro.**

Leonardo Fea ed i suoi viaggi. Cenni biografici di R. Gestro. Genova, 1904. Size 10 × 7, pp. 60. *Portrait and Maps. Presented by the Author.*

Fea was known principally as an enthusiastic zoological collector in Burma, West Africa, etc. He was also an expert engraver on wood.

GENERAL.

Bibliography. **Baschin.**

Bibliotheca Geographica, herausgegeben von der Gesellschaft für Erdkunde zu Berlin. Bearbeitet von Otto Baschin. Band ix. Jahrgang 1900. Berlin: W. H. Kühl, 1903. Size 9½ × 6, pp. xvi. and 510. *Presented by the Gesellschaft für Erdkunde, Berlin.*

Geography. **Mill.**

An Elementary Class-Book of General Geography. By H. R. Mill, D.SC., LL.D. London: Macmillan & Co., 1904. Size 7½ × 5, pp. xiv. and 382. *Illustrations. Price* 3*s.* 6*d. Presented by the Publishers.*

In this edition the book has once more been thoroughly revised, recent political changes and colonial developments being noted, and population statistics brought up to date.

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

Central Europe. **Liebenow and Ravenstein.**

Liebenow-Ravenstein's Special-Radfahrerkarte von Mittel-Europe. Scale 1 : 300,000 or 4·7 stat. miles to an inch. Sheets: 69, Hertogenbosch; 82, Brüssel; 83, Maastricht; 96, Valenciennes; 97, Givet; 109, Beauvais; 110, Reims; 111, Verdun; 120, Trentschin; 123, Paris; 124, Châlons-sur-Marne; 125, Bar le Duc; 131, Budweis; 132, Znaim; 133, Lundenburg; 139, Langres; 145, Linz; 146, St. Polten; 147, Wien; 153, Dijon; 154, Basel; 155, Zürich; 156, Bregenz; 157, Innsbruck. Frankfurt-a.-M.: Ludwig Ravenstein, [1904].

England and Wales. **Bartholomew.**

The Survey Atlas of England and Wales. A series of eighty-four plates of maps and plans, with Descriptive Text, illustrating the Topography, Physiography, Geology, Climate, and the Political and Commercial Features of the Country. Designed by and prepared under the direction of J. G. Bartholomew, F.R.S.E., F.R.G.S. Parts xvii. and xviii. Edinburgh: John Bartholomew & Co., 1903. *Price* 2*s* 6*d. each part. Presented by the Publishers.*

These parts contain plates 28, 34–37, 40–42, forming the following sections of the 2-mile-to-the-inch general map of England and Wales: xvii. (Chester and Manchester); xviii. (Newark and Grantham); xxiv. (Derby and Nottingham); xxv. (Crewe and the Potteries); xxvi. (Bala and Wrexham); xxix. (Montgomery); xxx. (Wolverhampton); xxxi. (Birmingham and Rugby).

England and Wales. **Ordnance Survey.**

Ordnance Survey of England and Wales:—Sheets published by the Director-General of the Ordnance Survey, Southampton, from July 1 to 31, 1904.

2 miles to 1 inch:—

Printed in colours, New Forest and surrounding country, parts of sheets 78, 79, 86, 87, 95, 96, 1*s.* 6*d.*; Monmouth, sheet 69, 1*s.*

1 inch:—

Printed in colours, 254, 1*s.* (third edition).
District map, with roads in colour, New Forest: encased, on paper, 1*s.*, or mounted on linen, 1*s.* 6*d.* (third edition).
(Third edition) in outline, 218, 1*s.* (engraved).
(Third edition) with hills in brown or black, 218, 268, 285, 1*s. each* (engraved).

6-inch—County Maps (first revision):—

Brecknockshire, 5 S.E. **Gloucestershire,** 71 N.W., N.E., 72 S.E. **Herefordshire,** 8 N.W., 11 S.W., 12 S.E., 18 N.E., S.E. **Leicestershire,** 19 N.W., S.E., 22 N.E., 24 S.E., 31 S.E., 38 S.E. **Radnorshire**, 22 S.E. **Shropshire** (80 S.W., S.E.), 83 N.W., N.E., 84 N.W. **Somersetshire** (4 N.W. and N.E.), (9 S.W. and S.E.), 14 N.E., 16 N.E., 16 S.W., 18 S.W., 20 N.W., S.E., 25 S.W., S.E., 26 N.E., S.W., 27 S.E., 29 S.E., 30 S.W., 31 N.W., 34 N.E., 38 S.W., 41 N.W., 42 S.W., 42 S.E., 44 N.E. (44 S.E. and 56*a* N.E.), 52 S.E., 54 S.W., S.E., 64 N.W., 65 N.E., 73 N.E., 73 S.E., 75 N.E., S.W. **Staffordshire**, 71 S.E. **Suffolk**, 80 S.E., 81 S.W., 82 N.W., 83 S.E. **Warwickshire**, 6 S.W., 8 N.E. **Worcestershire**, 4 S.E., 19 N.W., N.E. **Yorkshire**, 284 N.E., 290 N.W., 301 N.W.

25-inch—County Maps (first revision):—

Brecknockshire, XXIX. 1, 5, 9, 13; XXX. 2; XXXIV. 2, 3, 4, 6, 7, 8, 10, 11, 12; XXXV. 1, 2, 3, 5, 6, 9, 10; XXXVI. 1, 9, 10; XXII. 14; XXIII. 14; XXIV. 5. **Devonshire**, VII. 3; IX. 1, 2, 3, 4, 5, 6, 7, 8; X. 3, 4, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16; XI. 5, 9, 10, 13, 14; XIV. 4, 8, 11; XV. 9, 10, 13; XXI. 3, 4, 7, 8; XXII. 1, 2, 4, 5, 6, 7, 8; III. 11, 15; VI. 11, 15, 16. **Herefordshire**, IX. 16; XIV. 2; XXXVII. 5; XLIII. 2; XLVII. 13, 15; LI. 9, 12, 16; LII. 2, 3, 6, 7, 8, 9, 10, 13, 14; LIII. 3; LIV. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11; LV. 1, 2. **Leicestershire**, X. 16; XI. 13, 14; XII. 13; XVII. 4; XVIII. 1. **Lincolnshire**, CXXX. 4; CXLVI. 3, 4, 13, 14; CXLVII. 1, 2, 3, 5, 8, 10, 11, 12, 16; CXLVIII. 1, 5, 9, 10; CLI. 3, 9. **Rutland**, VII. 13, 14; XIII. 15; XIV. 3, 6. **Somersetshire**, VI. 6; VII. 10; VIII. 6. **Suffolk**, XXXII. 5, 6, 7, 8, 11, 12, 15, 16; XXXIII. 5, 6; XLIII. 10, 14; XLIV. 2, 6, 9, 10, 11; XLV. 3, 5, 7, 10, 11, 12, 14, 15, 16; XLVI. 2, 3, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16; XLVII. 1, 2, 3, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16; XLVIII. 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15; XLIX. 5, 6, 7, 8, 9, 10, 11, 12, 14, 15, 16; L. 5, 6, 7, 8, 9, 11, 13 (16 and LI. 13); LI. 5, 9; LX. 1 (4 and LXA. 1); LXXVI. 2. **Warwickshire**, XIII. 10, 14, 15; XVI. 15, 16; XLII. 11. **Worcestershire**, IIIA. 16; V. 10, 13, 14, 15; VII. 11, 12, 14, 16; X. 1, 2, 3, 5, 6, 7, 9, 10, 11, 13, 14, 15; XII. 4; XVI. 1, 2, 3; XX. 13; XXX. 13, 14, 15; XXXIII. 2, 3, 4; XXXIV. 14, 15; XXXV. 1, 2, 3, 5, 6, 7, 9, 10, 11; XLI. 2, 3, 6, 7, 10, 11.

(E. Stanford, London Agent.)

Germany. **Königl. Preuss. Landes-Aufnahme.**

Karte des Deutschen Reiches. Scale 1 : 100,000 or 1·6 stat. mile to an inch. Sheets: 265, Gardelegen; 315, Luckenwalde. Herausgegeben von der Kartogr. Abtheilung der Kgl. Preuss. Landes-Aufnahme, [1904]. *Price* 1.50 *mark each sheet.*

Luxemburg. **Hansen.**

Carte topographique der Grand-Duché de Luxembourg par J. Hansen. Scale 1 : 50,000 or 1·3 inch to 1 stat. mile. Sheets: 1, Troisvierges; 2, Clervaux; 4, Wiltz; 5, Vianden; 7, Redange; 8, Diekirch-Mersch; 9, Echternach. Paris: Erhard Freres, [1904].

Since the year 1883 Mr. J. Hansen, of Paris, has been engaged upon a survey of the Grand Duchy of Luxembourg, on the scale of 1 : 20,000, the results of which are now being published on a reduced scale (1 : 50,000) in fifteen sheets, of which the above are the first five to be issued. The relief is shown by form lines in brown, resembling regular contours, while figures in the same colour express definite heights of points in metres. Roads, which are clearly distinguished according to their relative importance, are in red, and forests and wooded land in green. The map is clearly drawn, and generally well produced.

ASIA.

China. **Königl. Preuss. Landes-Aufnahme.**

Karte von Ost-China. Scale 1 : 1,000,000 or 15·8 stat. miles to an inch. Sheet: Tschang tu fu. Kartographische Abtheilung der Königl. Preuss. Landes-Aufnahme, 1904. *Price* 1.50*m.*

Chinese Turkestan. **Hedin.**

Map showing Dr. Sven Hedin's journey from Lajlik to Jangi-köl and to Jurt-tschapghan, 1899–1900. Scale 1 : 100,000 or 1·6 stat. mile to an inch. *Petermanns Geographische Mitteilungen*, Jahrgang 1904, Tafel 11. Gotha: Justus Perthes, 1904. *Presented by the Publisher.*

Eastern Asia. **The "Times."**

The *Times* Map of the Russo-Japanese War. Compiled from sources and telegrams practically exclusive to the *Times*. Scale 1 : 2,217,600 or 5 stat. miles to an inch. London: The *Times* Office, 1904. *Price 5s. net.*

Although many maps have been published of the seat of war in the Far East, as might be expected when it is remembered that, with the exception of the coast-line, nothing but rough route surveys have ever been attempted, these differ widely from one another. Doubtless the best maps of Southern Manchuria and Korea are those which have been prepared from sketches of Japanese officers, but as these are in native character, they would be of little service to the ordinary individual in this country, even if they were readily accessible. The *Times* map certainly contains more names of places than most others, but it is in many respects very unreliable, and some serious errors occur, one being the course of the Lau ho, which is shown much too far to the west. The map is printed in colours, and is a decidedly rough production, but it will be found useful in following the operations of the Russo-Japanese war. In addition to the principal map, there are insets of the Siberian railway, Port Arthur, the port of Niu-chwang, and the approaches to Vladivostok.

Japan. **Japanese Imperial Geological Survey.**

Geological Survey of Japan Reconnaissance Map. Topography. Division 1. Scale 1 : 400,000 or 6·3 stat. miles to an inch. 4 sheets. Revised. Tokyo, 1900. *Presented by the Imperial Geological Survey of Japan.*

This is a revised edition of a general map of Japan which was first published in 1884.

Kwan-tung Peninsula. **Service Géographique de l'Armée, Paris.**

Environs de Port Arthur et de Dalny d'après le Carte Russe à 1:210,000, les croquis du Capitaine d'Amade et les cartes marines. Scale 1 : 100,000 or 1·6 stat. mile to an inch. Paris: Service Géographique de l'Armée, 1904. *Price* 1.25*fr.*

Philippine Islands. **Military Information Division, U.S.A.**

Map of the Philippine Islands. Scale 1 : 792,000 or 12·5 stat. miles to an inch. 4 sheets. Compiled from the latest official data in the Second (Military Information) Division, Office of the Chief of Staff, War Department, Washington, U.S.A., 1904. *Presented by the Chief of Staff, Second (Military Information) Division, U.S.A.*

AFRICA.

Africa. **Intelligence Division, War Office.**

Africa. Scale 1 : 250,000 or 3·9 stat. miles to an inch. Northern Nigeria (Provisional). Sheets: 62—A, B, E, F, I, J, M, N. London: Intelligence Division, War Office, 1904. *Price* 1*s.* 6*d. each sheet. Presented by the Director of Military Operations.*

Gold Coast. **Stanford.**

Sketch-map of the Gold Coast Government Railway, Sekondi to Kumasi, showing stations and positions of private sidings. Scale 1 : 253,440 or 4 stat. miles to an inch. Messrs. Shelford & Son, consulting engineers. *Price* 2*s.* 6*d.* London: Edward Stanford, 1904. *Presented by the Publisher.*

AMERICA.

Canada. **Surveyor-General's Office, Ottawa.**

Sectional Map of Canada. Scale 1 : 190,080 or 3 stat. miles to an inch. Carlton sheet (54), West of Third Meridian, revised to June 17, 1904; Vermilion sheet (71), West of Fourth Meridian, revised to June 17, 1904; Seymour sheet (92), West of Sixth Meridian, revised to July 5, 1904. Ottawa: Surveyor-General's Office, 1904. *Presented by the Surveyor-General of Canada.*

Nicaragua. **Bureau of the American Republics.**

Nicaragua. Scale 1 : 729,000 or 12·5 stat. miles to an inch. From official and other sources, prepared in the International Bureau of the American Republics, Washington, 1903. *Presented by the Director of the International Bureau of the American Republics.*

These two maps contain a considerable amount of information concerning the commercial and physical geography of Nicaragua. The first shows hills in brown shading, boundaries and rivers, in addition to which are indicated, by various symbols, telegraph lines, submarine cables, steamer lines, railways, the heads of navigation of rivers for steamships and canoes, gold and silver workings, altitudes in feet, and other interesting information. The second map shows the relief by tinted contours, and then by different symbols and colours, the districts of extensive cultivation of coffee, cacao, indigo, bananas, sweet potatoes, rice, sugar-cane, tobacco, and other agricultural products. As many parts of the country are but little known and only very roughly mapped, much of the information can only be considered approximate.

United States. **U.S. Geological Survey.**

Geologic Atlas of the United States. Scale 1 : 125,000 or 1·8 stat. mile to an inch.

Folios: 91, Hartville; 92, Gaines; 93, Elkland-Tioga; 94, Brownsville-Connellsville; 95, Columbia; 96, Olivet; 97, Parker; 98, Tishomingo; 99, Mitchell; 100, Alexandria; 101, San Luis; 102, Indiana; 103, Nampa; 104, Silver city; 105, Patoka; 106, Mount Stuart. Washington: Department of the Interior, U.S. Geological Survey, 1904. *Presented by the U.S. Geological Survey.*

AUSTRALASIA.

Australasia. **Stanford.**

Stanford's Library Map of Australasia. Scale 1 : 4,089,064 or 64·5 stat. miles to an inch. New edition. 4 sheets. London: Edward Stanford, 1904.

Important corrections have been made to this map since the last edition was published, but it still needs further revision, specially as regards German New Guinea, and the adjacent islands of New Pommern and Neu Mecklenburg, and the island of Celebes.

GENERAL.

World. **Hartleben.**

A. Hartleben's Volks-Atlas enthaltend 72 Karten in Einhundert Kartenseiten. Vierte-Auflage. Lieferungs 2–10. Vienna and Leipzig: A. Hartleben, [1904]. *Price 50pf. each part.*

The first issue of this atlas was noticed in the August number of the *Journal.* The present parts contain the following maps: Part 2, Physical map of the Alps; Norway and Sweden; Central America; Kaiser Wilhelm-Land and Bismarck Archipelago. Part 3, Colonial and Commercial map of the World; Upper and Lower Austria; Malay Archipelago; British South Africa. Part 4, Germany; Rumania; Caucasus. Part 5, Italy; South Brazil; Australia and Polynesia. Part 6, Polar Regions; Race distribution; European Russia; Egypt. Part 7, Switzerland; Bohemia, Moravia, and Silesia; America. Part 8, Special map of Germany; Balkan peninsula; Pacific islands. Part 9, Oceanic depths and currents; United Kingdom; Asia. Part 10, Austro-Hungary; South-west Russia; Asia Minor; Southern India.

World. **Petrie and Schokalsky.**

Marcks' Large General Table Atlas. Edited by Prof. E. J. Petrie and Colonel J. de Schokalsky. Part 7. St. Petersburg: A. F. Marcks, 1904. [In Russian.] *Presented by the Publisher.*

This part contains plates: 2–9, Climatological and ethnographical maps of the world; 13, Central Europe on the scale of 1 : 3,500,000; 27, European Russia (sheet 13) on the scale of 1 : 2,000,000.

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published by the Hydrographic Department, Admiralty, during May and June, 1904. *Presented by the Hydrographic Department, Admiralty.*

No.	Inches.	
3381 m =	6·9	Scotland, west coast. Hebrides, Lewis:—West Loch Roag. 3*s.* 6*d.*
3384 m =	14·0	Ireland, south coast:—Queenstown. 2*s.* 6*d.*
3415 m =	1·9	Baltic sea. Gulf of Bothnia:—Approaches to Räfsö and Biörneborg. 2*s.* 6*d.*
3416 m =	3·59	France, west coast:—Approach to Brest. 2*s.* 6*d.*
1233 m =	6·0 4·5	Black sea, plans:—Kustenjeh (Constanta) anchorage. Bender Erekli. 1*s.* 6*d.*
3405 m =	6·0	Newfoundland, east coast. Bay of Exploits:—Peter arm. 1*s.* 6*d.*
3390 m =	0·76 12·16	North American lakes. Lake Huron:—St. Clair river to Goderich (Plan:—Goderich harbour). 2*s.* 6*d.*
3424 m =	1·0	South America. Tierra del fuego. Beagle channel:—Cape San Pio to Gable island. 2*s.* 6*d.*
3425 m =	1·0	South America. Tierra del fuego. Beagle channel:—Gable island to Lapataia bay. 2*s.* 6*d.*
3426 m =	1·25 10·0	Philippine islands. Plans on the north coast of Mindanao:—Port Misamis. Port Langaran. 2*s.* 6*d.*
1016 m =	1·0	Cochin China:—Saigon or Don nai river. 2*s.* 6*d.*
2653 m =	2·4	China, north coast:—Peiho or Peking river, Sheet I., from the entrance to Ko-ku (*Reproduction*). 2*s.* 6*d.*
1663 m =	3·5 3·6	Japan. Plans on the south coast of Yezo:—Fukuyama byochi. Fukushima byochi. 1*s.* 6*d.*

No.

1772 Ireland, east coast. Approaches to Wexford harbour. Plan added:—Rosslare harbour.

2113 Sicily. Plans of anchorages on the west coast. Plan added:—Sciacca.

1149 Iceland. Plans on the west coast. Plans added:—Budir Krossvik.

801 West Indies. Haïti or San Domingo. Approaches to Port au Prince. Plan added:—Jeremie bay.

3138 Alaska. Anchorages in south-east. Plan added:—Yes bay.

935 Eastern archipelago. Harbours and anchorages between Bali and Timor. Plan added:—Sermata, west point.

2468 Eastern archipelago. Selabu, west coast. Plan added:—Warain road.

2772 Sulu sea. Anchorages in Gillolo. Plans added:—Ekor and Galela roads. Bobani bay and Pasir Putih anchorage.

3392 Philippine islands. Plan added:—Port San Vicente.

1641 China, east coast. Harbours and anchorages on the coast of Formosa. Plan added:—Taihanroku anchorage.

1280 Korean archipelago. Port Hamilton. Plan added:—U-to anchorage.

1999 New Zealand. Ports Lyttelton and Levy. New Plan:—Lyttelton harbour.

2591 New Zealand. Sheet XIV. Plan added:—Greymouth harbour.

1490 South Pacific ocean. Harbours and anchorages in the Sandwich islands. Plan added:—Kaanapali anchorage.

(*J. D. Potter, Agent.*)

Charts Cancelled.

No.		Cancelled by	No.
1233	Kustenjeh anchorage.	New sheet. Kustenjeh anchorage, Bender Erekli . .	1233
2387	Bendor Erekli.		
678	Goderich harbour. Plan on this chart.	New plan. Goderich harbour on chart	3390
803	Jeremie bay. Miragoane harbour.	Reduced plan of Jeremie bay on chart . .	801
599	Approaches to Ushuwaia Mission Station and Lapataia bay. Plans on this sheet.	New chart. Gable island to Lapataia bay	3425
581	Farewell harbour. Plan on this sheet.		
957	Port Misamis. Plan on this sheet.	New plan. Port Misamis	3426
2454	Port S. Vicente. Plan on this sheet.	New plan. Port San Vicente on sheet.	3392
2653	Peiho or Peking river.	New plan of same	2653

(*J. D. Potter, Agent.*)

Charts that have received Important Corrections.

No. 1698, England, south coast:—Dover bay. 1185, England, river Thames:—Sea reach. 2030, Ireland, south-west coast:—Valentia harbour. 3158, Norway:—Newlunghavn to Torbiornskier. 3159, Norway:—Torbiornskier to Jœlöen. 3160, Norway:—Torbiornskier to Ranö. 1297, Norway:—Lepsö to Ona. 1298, Norway:—Approaches to Molde. 2307, Norway. Sheet V.: Smölen to Sves fiord. 2315, Norway. Sheet XIII.: Sörö to North cape. 2316, Norway. Sheet XIV.: North cape to Tana fiord. 2331, Baltic, Gulf of Finland:—Hangö head to Barö sound. 1458, Spain, east coast:—Ports and anchorages. 2740, Iceland and the Færoe islands. 565, Iceland, western portion. 566, Iceland, eastern portion. 3017, North American lakes:—Duluth and Superior harbours. 2538, Nova Scotia, Bay of Fundy:—Yarmouth to Petit passage. 2488, United States, east coast:—Portland harbour. 2580, West Indies:—Cuba, eastern portion. 2600, West Indies:—San Domingo to Dominica. 1501, Alaska, Aleutian islands:—Seguam island to Attu island. 1064, Madagascar:—Plans on the north-east coast. 40, India, west coast:—Karachi harbour. 859, Bay of Bengal:—Mutlah river to Elephant point. 934, Eastern archipelago:—Surabaya, etc. 3349, Cochin China:—Approach to Kwang chau wan. 3386, China, east coast:—Long harbour and approaches. 166, China, east coast:—Pagoda anchorage. 372, Japan, Kiusiu, west coast:—Gulf of Kagosima, upper part. 764, New Guinea, etc.:—New Hanover, New Ireland, and New Britain.

2527, New Zealand. Sheet III.: Mayor island to Poverty bay. 2411, New Zealand:—Otago harbour. 1913, New Hebrides:—Malekula, Northern part. 1579, New Hebrides:—Malekula, southern part.

(*J. D. Potter, Agent.*)

North Atlantic and Mediterranean. **Meteorological Office**

Pilot Chart of the North Atlantic and Mediterranean for August, 1904. London: Meteorological Office. *Price 6d. Presented by the Meteorological Office, London.*

United States Charts. **United States Hydrographic Office.**

Pilot Chart of the North Atlantic Ocean for July, and of the North Pacific Ocean for August, 1904. U.S. Hydrographic Office, Washington, D.C., 1904. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

California. ———

An album of twenty-two views of the Spanish Mission Stations in California. *Presented by C. H. Wallroth, Esq.*

Mr. Wallroth is a most generous contributor to the Society's collection of photographs, and many excellent albums have been presented by him. To these he now adds this interesting set of large photographic reproductions, which appeared in the supplement to the San Francisco *Sunday Chronicle* for September 13, 1903:—

(1) Ruina of Mission San Diego de Alcala; (2) Mission San Luis Rey de Francisco; (3) Mission San Antonio de Palo; (4) Ruins of the old Mission San Juan Capistrano; (5) Mission San Gabriel Arcangel; (6) Mission San Fernando Rey de Espana; (7) Mission San Buena Ventura; (8) Mission Santa Inez; (9) Mission La Purisima Concepcion; (10) Mission Santa Barbara; (11) Mission San Luis Obispo de Tolosa; (12) Mission San Miguel; (13) Mission San Antonio de Padua; (14) Mission San Juan Bautista; (15) Mission Nuestra Senora de la Soledad; (16) Mission San Carlos Borromeo; (17) Mission Santa Cruz; (18) Mission San Jose; (19) Mission Santa Clara; (20) Mission San Francisco de Asis; (21) Mission San Rafael Arcangel; (22) Mission San Francisco de Solano.

China. **Hicks-Beach.**

Thirty photographs of North China and Mongolia, taken by M. H. Hicks-Beach, Esq. *Presented by M. H. Hicks-Beach, Esq.*

These photographs were taken during the journey of Messrs. Russell and Hicks Beach described in the *Geographical Journal* for May last. They are of special interest from the fact that our knowledge of a greater part of the region traversed is very slight. The titles are as follows:—

(1) The Prince of Chastuchi; (2) The Prince of Chastuchi and suite; (3) Prince's enclosure, Chastuchi; (4) Guest huts, Chastuchi; (5) Fording a stream in Mongolia; (6 and 7) Mongol men and boys; (8) Mongol men and women; (9) Mongol men; (10) Mongol huts; (11) Mongols with salt-carts; (12) Mr. Russell's servants, transport mules and ponies; (13 and 14) Mongolian ponies; (15) A valley in Mongolia; (18 and 19) Lamassery, Ying Cheka Miao; (20) Parta; (21) Plaster relief on wall of Parta; (22) Hot springs, Lung Shan; (23) Farm house group in Wei Cheng; (24) Fording the I-sun Ho; (25) Lama temple, Jehol; (26 and 27) Lamassery, Jehol; (28) Carts in courtyard of inn at Jehol; (29) Execution procession, Jehol; (30) The Great Wall at Kupikiu.

Nyasaland. ———

Six photographs illustrating the tobacco cultivation in Nyasaland.

All who are specially concerned in the development of British Central Africa will be interested in these photographs. They are half-plates, and are very good specimens.

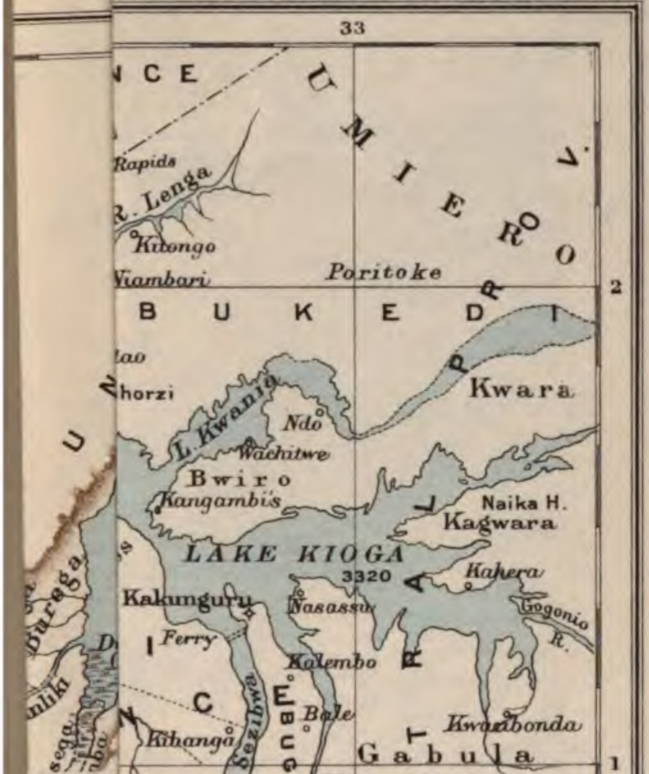
(1) Preparation of soil; (2) Curing-barn in course of erection; (3) Seed beds under gauze; (4) Tobacco leaf specimens; (5) Curing-shed; (6) Plantation, Havana plants.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

WESTERN UGANDA.

FISHER.

THE GEOGRAPHICAL JOURNAL, 1904.



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The
Geographical Journal.

No. 4. OCTOBER, 1904. Vol. XXIV.

RETURN OF THE NATIONAL ANTARCTIC EXPEDITION.

The safe return to this country, during the second week in September, of the National Antarctic Expedition in the *Discovery*, has brought to a close an enterprise which, for the value of the results achieved, is certainly worthy of a very high place alike in the roll of polar expeditions, and in the long series of peaceful enterprises for which, as well as for her warlike victories, the British navy has ever been distinguished. The expedition, it may be recalled, has passed no less a period than two years and two months within the Antarctic circle; and while, in the trying circumstances inevitable in such a case, much of the success is certainly due to Captain Scott's rare gifts for command, almost as much is to be ascribed to the devoted loyalty and zeal of officers and men. All alike have done splendid work, and all alike have earned the thanks of their countrymen. The well-deserved honours already conferred on the explorers by the King and the Board of Admiralty are referred to below.

The task entrusted to Captain Scott and his companions in the official instructions was one which in any case must make large demands on the courage and skill of all concerned. To have performed such a task would have marked the expedition as a success. But the explorers have done much more: the second winter and the second travelling season have more than doubled the importance and value of their work. The perils and difficulties have been great, and such as only polar men can fully appreciate; but the reward has been great also. Extensive geographical discoveries have been made, and careful surveys carried out, while in other branches of science the results are no less striking.

The discovery of a fossil flora in the far south is of great scientific importance, while the biological collections are quite unique, for they are the first ever made 700 miles to the south of the antarctic circle. The careful meteorological records are more than doubled in value by their extension over two years; and the same may be said of the magnetic observations, of which those taken with the Eschenhagen instruments form a continuous record, including 700 magnetograms. It is, of course, premature to anticipate final results, though there are fascinating problems awaiting solution; but it may be mentioned that whereas, on November 1, 1903, a magnetic storm prevailed from Potsdam to New Zealand, the same day showed one of the most important magnetic disturbances recorded at the *Discovery's* winter quarters. The value of the observations for declination, inclination, and total force during the memorable journey over the great ice-sheet is enhanced by the fact that the effect of local disturbances was completely eliminated. The observations will therefore be of use in fixing the position of the magnetic pole. The rest of the physical work, including gravity, seismic, tidal, and other observations, such as those for atmospheric electricity, were likewise steadily continued through both years.

It will be remembered that, after her voyage across the South Pacific and a successful passage through the Straits of Magellan, the *Discovery* touched at the Falkland islands in the latter part of July, although the news, which came by mail, was only received in this country a month later. It was quickly followed by the announcement of the safe arrival at the Azores, the probable date of arrival at Spithead being then given as about September 10. As throughout the whole voyage, the ship kept well up to time to the last, being signalled off Plymouth in the afternoon of September 9, and reaching Spithead early on the 10th. She was soon afterwards boarded by a party from the shore, including Sir Clements Markham, who, with various friends of the officers, remained on board during the passage to Spithead, where the ship was swung for the adjustment of the compasses, etc., afterwards steaming to the dockyard, which was reached about dusk. Both officers and crew were in the best of health and spirits, while the trim and well-kept appearance of the ship excited much attention.

During its stay in Portsmouth the expedition met with a most cordial reception both from the authorities and the general public, who alike showed a gratifying appreciation of the work done by the explorers. All, from the mayor downwards, exerted themselves to make the stay a pleasant one, and the arrangements for the first public reception of the members of the expedition were carried out with the utmost heartiness and success. A formal welcome was accorded to both officers and crew at a dinner given in their honour by the mayor (Major J. E. Pink) on September 13. Captain Scott sat on the right of the mayor, and among the guests were Mr. A. H. Lee, M.P., Civil Lord of the Admiralty, Sir Clements Markham, Admiral Sir Vesey Hamilton, Sir Allen Young, Admiral Field, Rear-Admiral Henderson (superintendent of Portsmouth dockyard), and many others. In proposing the toast of the evening, the mayor spoke of the "British grit" displayed by the members of the expedition, and expressed the opinion that Captain Scott had been associated with one of the greatest peace victories of the British Navy since the days of Parry and Ross. In replying, Captain Scott said that out of thirty-seven who remained during the second winter, thirty belonged to the Royal Navy, so that in coming to Portsmouth they felt like coming back home. Sir Clements Markham spoke of the assistance rendered by the Admiralty, while Mr. Arthur Lee welcomed the expedition home in the name of that body.

The public reception of the expedition in London took place on September 16, and was of an equally cordial and successful character. The *Discovery* sailed from Spithead on the 14th, arriving at the East India Dock on the following afternoon. Invitations to a luncheon at the docks had been sent in the names of the Presidents of the Royal and Royal Geographical Societies to the officers and crew of the *Discovery*, and to a number of other guests, who assembled at 1 p.m. of the 16th in one of the warehouse sheds adjoining the docks, many of them having first inspected the ship as she lay alongside the jetty. Sir Clements Markham occupied the chair, and was supported by Mr. A. B. Kempe, treasurer of the Royal Society, the places of honour being filled by Captain Scott and Lieut. Armitage, respectively leader and second in command of the expedition. Among the company present were (of old Arctic explorers) Admirals Sir Vesey Hamilton, Sir George Nares, Sir Lewis Beaumont, Rear-Admiral Aldrich, and Sir Allen Young; Mr. W. S. Bruce, leader of the Scottish Antarctic Expedition; the Right Hon. W. E. Macartney; Sheriff Sir A. Reynolds, Sir Henry Bulwer, Sir G. Taubman-Goldie, Sir H. H. Johnston, Sir G. Mackenzie, Admiral the Hon. Sir E. Fremantle, Vice-Admiral Sir Arthur Moore, Vice-Admiral Sir R. Harris, Rear-Admiral Sir W. Wharton, Colonel Church, Mr. L. W. Longstaff, Major Leonard Darwin, Mr. J. F. Hughes, Dr. J. Scott Keltie, Sir R. Giffen, Sir H. Tozer, Capt. E. W. Creak, Capt. A. M. Field, Capt. D. Wilson-Barker, president of the Royal Meteorological Society, and Mr. Cyril Longhurst, Secretary of the Expedition. The ship's officers and scientific staff were, in addition to those already named, Lieut. C. W. Royds, R.N., Eng.-Lieut. R. W. Skelton, R.N., Dr. R. Koettlitz (chief medical officer), Mr. T. V. Hodgson (biologist), Dr. E. A. Wilson, Mr. H. T. Ferrar (geologist), Mr. L. Bernacchi (magnetic observer), Lieut. M. Barne, R.N., and Lieut. G. F. Mulock, R.N. Lieut. E. H. Shackleton, who was invalided home last year, was also present.

After luncheon the members of the expedition were welcomed by representatives of the Admiralty, the City, the Royal Society, and the Royal Geographical Society. The following speeches were made:—

Sir **Clements Markham** said he was pleased to tell the officers and men of the *Discovery* that the King had been graciously pleased to summon Captain Scott to Balmoral for a few days. His Majesty had expressed the wish that the captain should take with him the photographs and sketches taken on the voyage, a request which doubtless would give pleasure to Dr. Wilson and Lieut. Skelton.

Vice-Admiral Sir **Lewis Beaumont** said he had the pleasure of being the representative of the Admiralty on that occasion, as, owing to circumstances over which they had no control, the First Lord and other Lords of the Admiralty were prevented from being present. He was privileged to convey the following greeting from the First Lord to Captain Scott and his comrades: "Will you tell Captain Scott and his officers and men the satisfaction of the Board of Admiralty at the manner in which they have so thoroughly upheld the traditions of the Navy, and with what pleasure they greet them on their return to England?" He knew that the Admiralty always took a deep interest in explorations of this sort. They looked upon the work as being equivalent certainly to any other kind of peace work; indeed, as hardly inferior to the most arduous and distinguished service before the enemy. It was already known that the explorers had been rewarded with medals for their exploits, but this might be considered the official announcement, the First Lord's words being, "Will you also announce to them that His Majesty has graciously notified his intention to confer upon them a medal to commemorate their expedition, which will of course be worn by them as the Arctic medals of former expeditions have been worn;" and he might mention that the Arctic medal was not inferior in its significance to any war medal. Being an old Arctic, he desired to take this occasion of welcoming them on behalf of all the old Arctics. There were a number of gentlemen present who had had experience in Arctic discovery, dating as far back as 1850—such as the President of the Royal Geographical Society, Sir Vesey Hamilton, Sir George Nares; they were the veterans of Arctic exploration, and in their names and on behalf of all old Arctic officers he ventured to welcome home Captain Scott and his officers. There never had been jealousy among Arctic explorers, and in this instance all would be ready to give the very highest meed of praise to the present expedition. They had not only done their work most splendidly, but they had done it with a modesty which was a credit to all concerned. The Admiralty had already marked their approval of the work of the commander, by his promotion to the rank of captain, and would unquestionably mark their appreciation of the work done by his officers and men.

Sheriff Sir A. **Reynolds**, in the absence of the Lord Mayor, extended to the explorers the welcome and congratulations of the City of London.

In the absence of Sir W. Huggins, President of the Royal Society, who much regretted his inability to be present, Mr. **Kempe**, treasurer of the Royal Society, extended a hearty welcome to the voyagers on behalf of that body. He said that he much appreciated the duty he had to perform, as he had been closely connected with the work of the expedition, and had had it constantly in mind. It would, indeed, have been difficult for him to have forgotten their existence, as hardly a week passed in which it had not been his duty to sign cheques for them. He was charged by the President, Council, and Fellows of the Royal Society to offer the party their warm congratulations upon the accomplishment of the arduous work on which they had been engaged for so long, and their sincere thanks for the manner in which they had carried out the scientific investigations with which they had been entrusted. He did not speak as an expert, but he felt satisfied that the additions they had made to our scientific knowledge were important, and that their importance would be shown in the future. It was, of course, inevitable that some time must elapse before the full value of the work done could be properly estimated, and its meaning proclaimed to the world. The explorers, however, might rest satisfied that the results of their labours would be published long before the appreciation of those labours had faded away; that their endeavours were recognized by the nation was strongly exemplified by the action of the King. His Majesty had felt the nation's pulse, and had prescribed an Antarctic medal. The accuracy of the diagnosis and excellency of the prescription were evidenced by the glow of healthy satisfaction which had followed the dose. He (Mr. Kempe) had carefully refrained from referring to the names of particular workers on the expedition, because all deserved praise for what had been done; but he was sure they would pardon him for saying that they owed a particular debt of gratitude to Captain Scott for the consummate and continued care he had bestowed upon the health of the members of the expedition. As a member of the Finance Committee of the expedition, the fine condition in which the ship came back to our shores also appealed very strongly to him. He trusted the ship might find a proper and satisfactory berth, and that she might accomplish some good work in the future. On the Society's behalf, he wished them all long life and happiness, and other fields to conquer.

Sir CLEMENTS MARKHAM, representing the Royal Geographical Society, desired particularly to express their warm thanks to the warrant officers for the admirable way in which they had conducted their several departments. They had splendidly supported their officers, and he felt strongly himself that the discipline which existed on board had largely contributed to the healthful condition in which all had returned home. He was afraid there were many frost-bites, but no amputations had been necessary, and he considered that was largely due to the way in which the men had obeyed the instructions of their officers. He also congratulated the crew for the manner in which they handled the sledges. It was due to officers and men all working so well together that they had achieved so great a success; and now that they had returned, it must be with feelings of melancholy in leaving so interesting a region. He did not think there could be any doubt that they would regret very much leaving the old ship. That was intended to be a paying-off luncheon at which officers and men could meet together, therefore there was a certain melancholy feeling about it. They would always look back to the recent period of their lives, and feel that they had had opportunities to make them better and finer men. All wished them happiness and success in their future lives.

Captain SCOTT, who was enthusiastically cheered on rising to reply, said he felt somewhat overwhelmed, and he could only thank the many friends of his comrades and himself for the interest they took in the ship before her departure and throughout the expedition. He was speaking before many old Arctic explorers who were able to judge of Arctic work, and that enhanced the difficulty of his position. He never expected such a welcome as they had all received, and the award which had been made had been deeply appreciated by all. They, as naval men, had seen before, and had coveted, the little bit of white ribbon which they had now received. When they came home and heard that His Majesty considered their services had earned that ribbon, they had the profoundest feeling of gratitude. With regard to himself, he treasured the promotion which had been extended to him, and he felt that he had been amply rewarded for all that he had done. He was pleased to hear the suggestion that others would be rewarded, for Arctic exploration was not a one, two, or ten men show, but it needed the co-operation of all. They had all worked together. A spirit of good-will and comradeship had been maintained throughout, and from start to finish there had been nothing but loyalty and a desire to work for the general good. There had never been a thought of selfishness. They had not been actually under the King's regulations, but at the same time most of them were proud to be under them, and all in the ship had obeyed those regulations up to the letter. Whatever might come out in the way of scientific results, he could only say that the gentlemen who had been engaged in those investigations had done thoroughly hard and honest work, and more work than people generally knew. He was proud that he had been in command of such a company. He was very glad of having had an opportunity to say these things publicly, because now came the time when he parted from his comrades; now was the sad time of the breaking up of their small community. They had been a happy little body, and they parted from the *Discovery* with extreme regret. He thanked all present for the generous way in which they had welcomed them home.

The proceedings terminated with the toast of "Sir Clements Markham," proposed by Colonel G. E. Church, and a brief reply.

In the evening of the same day, a dinner of the Royal Geographical Society was held at the Criterion Restaurant. The guests included the officers of the expedition, and most of the visitors who were present at the luncheon. To the names of the old Arctic officers given above must be added that of Admiral Sir Leopold McClintock, who had been unable to be present at the earlier function, while the representative character of the gathering was enhanced by the presence of men of science like Sir W. Thiselton-Dyer, Prof. Sylvanus Thompson, Dr. W. N. Shaw, Mr. A. B. Kempe, and others. A large number of the members of the Society and their friends were also present, and the company altogether numbered nearly 300. The speeches which followed the dinner were listened to by a number of ladies, including several of the friends of the officers, and the giving of the toasts was interspersed with musical performances, including the singing of "Home, Sweet Home."

The President proposed "His Majesty the King, the Patron of the National Antarctic Expedition." He said His Majesty had taken a deep interest in geographical matters since his early youth, and he had within the last few hours shown how great was the interest that he continued to take in the explorations and labours of his subjects for extending our knowledge of the Earth's surface.

In proposing "His Royal Highness the Prince of Wales, Vice-Patron of the Expedition," the President said he should never forget the encouragement which he received from His Royal Highness at a time when he was almost in despair of being able to send out a relief ship.

The President next proposed "The Health of Captain Robert Falcon Scott, R.N., Commander of the Expedition." He said it was his pleasing duty to propose the toast of the evening. Superlatives were unnecessary; they all knew what Captain Scott had done. Captain Scott had made himself acquainted with all that had been done in the Arctic regions, but the conditions which prevailed in the Antarctic regions were in many respects very different, and he had been to a great extent an original polar traveller. They had not yet been able to read a full account of the journeys which Captain Scott had caused to be made, or of the magnificent journeys which he himself made over the ice. But they knew the distances that had been covered, and he thought they might say the journeys had not been surpassed, either in the difficulties overcome or in the importance of the results. Captain Scott might be described as the creator of sledge travel in the Antarctic regions. He had done a great service to his country. He had had most able assistance, and had shown himself to be a great commander. He was sure that Captain Scott and his officers would wish him to mention the hospitality and invaluable help that they received from the colony of New Zealand.

Captain SCOTT, who again met with a most enthusiastic reception, said it was three years since he entered into the employment of the two Societies which sent out the expedition. He entered into that new employment with considerable trepidation, and, he might add, with considerable ignorance of his subject. But whenever he asked for advice or assistance he was able to get it from the members of those Societies. He would like to tell them a great deal about the Antarctic, but he was sure there was not time that night. He would like to draw their attention to the facts which went to make such success as the expedition accomplished, and to bring to their minds a vivid picture of the work accomplished by the various officers and men. He would like to present to their minds the picture of Mr. Hodgson, staggering in with his arms full of frozen specimens, and distributing them over the ward-room table; of Mr. Royds, who had every morning to change his records with frost-bitten fingers; of Mr. Barne, who, on his famous sledge, the Flying Scud, disappeared in the darkness, nothing more being heard of him until, when they were getting anxious and were preparing a search party, he appeared on the scene again. He would like to tell them of Dr. Koettlitz, and all the rest of them. All were equally diligent, and it was to their continued diligence that they owed anything like success. In addition to that, they had good fortune in finding their winter quarters. They arrived at them by chance, but he did not believe that a more suitable spot could be selected. Their detention for a second winter was also extremely fortunate, though it did not appear to be so at the time. It had often astonished him since to think of the number of false impressions in regard to matters of detail that they would have come home with, and the number of facts that would have remained unobserved, had they returned a year sooner. It was to the second winter that they owed any measurement of the movement of the ice in those parts. Without it, they would have missed the great discovery of the fossils; they would have missed the great biological collection which Mr. Hodgson continued to make; and they would have missed knowledge of the interior of Victoria Land beyond the immediate mountains. Moreover, they would have missed two consecutive years of meteorological and magnetic observations. Although it caused them considerable anxiety and annoyance to stop behind, yet he could never look upon the circumstances as anything but a blessing in disguise. The Antarctic campaign at the beginning of this century was now practically at an end. It had been the greatest pleasure to him, on returning home, to receive telegrams and letters of welcome from others who had conducted expeditions to the southern regions. He had received the kindest letter from Prof. von Drygalski, and the kindest congratulations from Mr. Bruce, who was dining with them that night. He was able to return those congratulations, for Mr. Bruce's expedition went to a point of extraordinary interest, and in finding the limits of the Weddell sea had done precisely the work that they could have most wished to see done. Sir Clements Markham had spoken much too highly of his services, and he could only thank him for his kindness. He wished especially to thank him and the secretary of the Expedition Committee, Mr. Longhurst, for the great care they had taken to keep their relatives posted with the latest news of their movements.

The PRESIDENT then proposed "The Health of the Members of the Expedition." He said he wished that all the members of the expedition were present. They had had the great pleasure of sitting down with the warrant officers and men earlier in the day, and they now had with them the officers of the expedition. Captain Scott had told them how they had worked; they went forth with a determination to distinguish themselves as explorers. They took with them the banners which they saw behind him, and carried them into parts of the Earth where the human foot had never before trod.

The toast was cordially honoured, the company again rising and cheering heartily.

Lieut. ARMITAGE, R.N.R., who first responded, expressed the pleasure it had given him to be associated in the work with officers of the Royal Navy, dwelling also upon the loyal help rendered by the warrant officers and men. They could have done nothing if they had not had a commander who was also their comrade, and for whom they felt they could do anything, at any sacrifice.

Dr. KOETTLITZ, speaking more especially on behalf of the scientific staff, referred to the great interest taken by Captain Scott in their work, without which their task would have been far from easy. Captain Scott had been at great pains to make himself acquainted with the various branches of science to which their attention was devoted, with the result that he was able to discuss with them their methods of work, and make valuable suggestions. Captain Scott's promotion had given them all the greatest delight, and they looked upon it as an honour conferred on themselves.

Lieut. SKELTON dwelt on the many incentives which had spurred them on to do their best. Most of them belonged to the navy, and they felt that its reputation was to be jealously guarded. Moreover, the great interest of their work could not fail to make them keen to do all in their power, while no merit lay in loyalty to such a commander as Captain Scott.

Major DARWIN proposed the toast of "The Subscribers to the Expedition," saying that without their liberality the expedition could never have taken place. He spoke especially of the great assistance rendered by Mr. L. LONGSTAFF, who, in replying, laid stress on the importance of scientific research, which made it incumbent on all who had the power, to further it in every way possible.

The last toast of the evening was that of "The President," proposed by Sir GEORGE GOLDIE, who spoke of the debt which the expedition owed to Sir Clements Markham's untiring energy and faith in its ultimate success. The PRESIDENT, in reply, said that his strongest motive throughout had been the wish to afford the navy the opportunity of taking part once more in one of those enterprises which supplied so valuable a training in times of peace.

A JOURNEY TO THE NORTH OF THE ARGENTINE REPUBLIC.*

By FLORENCE O'DRISCOLL.

THE greater part of the journey I am about to describe was over a tract of country lying near the extreme north of the Argentine Republic, close to the borders of Chile and Bolivia—in part over the territories in dispute between Argentina and those countries.

For the purpose of description, the travelling began at the town of Jujuy, the capital of the Argentine province of Jujuy—also the terminus of the railways from Buenos Aires and other ports to the south. For travel northward from the town of Jujuy, arrangements were made for mule or horse troops. Although men were there who offered what they call good carriages and horses, I strongly advise travellers to depend solely on troop-mules for baggage and riding-mules for men.

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* Read at the Royal Geographical Society, May 30, 1904. Map, p. 504.

The Argentine Government were continuing the railway past the town of Jujuy, with the view of eventually connecting with the railways in Southern Bolivia that are linked with the Chilian railways whose ports are on the Pacific side of the Cordilleras. The construction of the railway past Jujuy has moved very slowly, since the border disputes between Chile and Argentina have progressed amicably. The route of road and railway north from Jujuy follows a natural valley—a river-bed, sometimes almost a cañon—that extends far into Bolivia, with an almost unvarying northerly direction, and the valley rises the whole way with a fairly regular slope. In July, 1903, the railway works had not extended more than 4 or 5 miles north of Jujuy. Along the route (known as the "Quebrada de Humahuaca") there are no special difficulties for railway engineers; they have simply to keep their line out of the river-bed and push it northward. There is, however, about 20 miles north of Jujuy, a place that may cause some difficulty, locally known as "El Volcan;" it is reputed to be a mud volcano, flowing across and down the valley. As I passed I examined it with some interest, but found it was not a volcano at all. There the valley was about 1½ mile wide; to the left or west there was a chain of hills, rising perhaps at their highest point 2000 feet above the river-bed. One of the highest of these peaks—still one of the highest, and indeed a very massive mountain—on the eastern side was mainly composed of fine, pasty, argillaceous matter that in wet weather held water like a sponge. The side of the mountain nearest the valley had broken away, and slid through a somewhat narrow gorge into the main valley, and poured its flow of mud completely across it. Always in wet weather vast masses of this stuff slide down the hollow cone-like sides of the mountain into the valley, and, together with millions of tons of the mud already in the valley, all take up water, and tremble and shake with the least vibration like a jelly on a hot day. Of course, while in that condition the bed of the valley is quite impassable; the mud-slide can only be passed by keeping up the hillsides, n an extremely difficult and very broken road situated on the opposite side of the valley to the mud mountain; usually no one attempts to travel while the mud-slide is in a bad condition. The place presents some terrors to the natives, and weird tales are told about the suddenness with which the "volcano" works; but if the tales be analyzed, they will be found always connected with heavy rainfalls. The place naturally retains moisture long after the surrounding country is quite dry, and the damp mist that fills the valley, with greater or less density according to the amount of moisture drying out of the mud-slide, is generally referred to as "smoke from the volcano." But there is no volcano; of this I was fully satisfied, after riding over the mud-slide and examining the mountain-sides with a powerful glass from a distance of about a mile. My view was verified subsequently by the chief of the Government railway, whom I met in Buenos Aires months afterwards. He said he had formed the same conclusions, after having examined the place in detail. The difficulty which it will present to railway construction will be one of drainage. When I passed over the place it was in the winter, when everything was dry; indeed, had I not experience of places similar to this in other parts of the world, I should have had much difficulty in believing the soft, jelly-like condition which the greater bulk of this vast mud-slide attains during the wet seasons of the year.

The valley from Jujuy northward is the main road to Bolivia, over which almost all the loading from the northern Argentine railway passes daily. Mule-trains, with sometimes as many as fifty or sixty animals, were continually met, each mule loaded up with cases or manufactured goods, tea, tobacco, flour, and general merchandise. As a rule, the returning mules carry alfalfa (lucerne) and timber to the higher lands in Argentina; and in lower altitudes nearer Jujuy, I noticed cargoes of apples and some cacao which had been brought from Bolivia, the great bulk of the other loading having been sold on the way south; but generally the greater number of mules return empty. In this valley I first saw pack llamas—the animals that do almost all the carrying in the higher lands of Bolivia.

We rode for five days up the valley; sometimes it was 2 or 3 miles wide, sometimes but 100 yards or so, rising slowly all the time, with a small stream, 15 to 20 feet wide and 12 to 18 inches deep, rushing down somewhere over the interminable stones and boulders that covered the entire valley bed. The hills on either side varied in contour every mile of the way; sometimes only a couple of hundred feet or so above the river-bed, in other places rising to 2000 or 3000 feet high. I was not sufficiently interested to turn aside and examine them geologically, but from the distance of the river-bed I could not observe anything but very recent sedimentary formations in their entire structure. At Jujuy the height was 4200 feet.* Each day I travelled from 20 to 25 miles northward, and rose about 2000 feet. The second day out I passed Tumbaya—known to those learned in the earlier history of the country as "Tumbaya la bella." There are few legends current of the Spanish occupation of this country, but almost every one in the locality knows the legend of a Spanish priest, who, a couple of hundred years ago, settled at Tumbaya with a view of converting the

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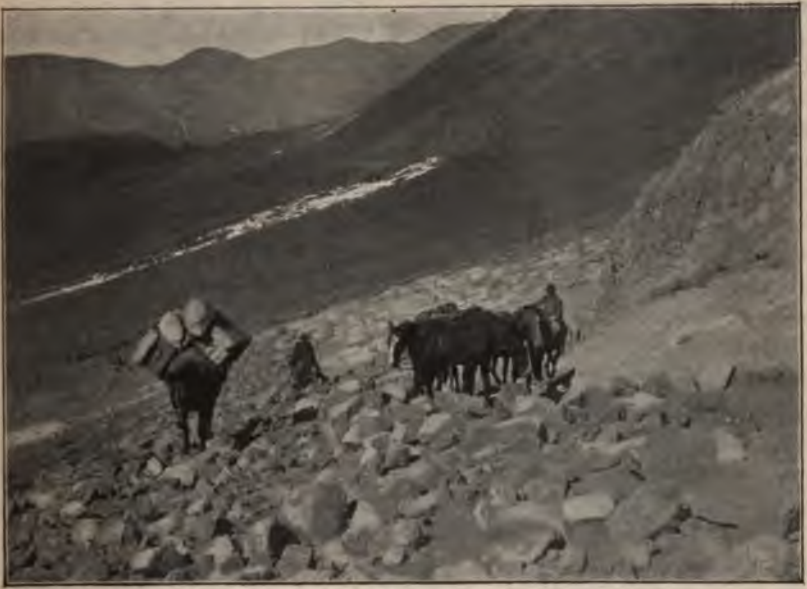
* All the heights I shall give are barometric readings, corrected as far as possible from sea-level observations.

Indians. After many years he left it, and all the history remaining is his anathema of the place and people. Now Tumbaya is a collection of mud huts, a plaza—fenced with wire, and full of broken bottles, empty tins, and rubbish—and a Government telegraph station. There was hardly a sign of life as we rode into the town; the few wretched dogs had hardly energy to bark. The lines of the long-forgotten priest are its only record of distinction.

All along the valley, wherever there was a collection of houses, I was greatly struck with the character of the architecture; like Arab or Moorish villages, one great wall without windows surrounding them.



ONE OF THE PASSES (NEARLY 17,000 FEET ABOVE SEA-LEVEL) APPROACHING THE "SEPULCRO," IN THE DEPARTMENT OF THE ANDES, ARGENTINA.

The country is very quiet now—safe enough for a bevy of school-girls to travel it by day or night; but still the peculiar architecture remains. At Negra Muerta, where we camped, there was only one large building, once the headquarters of the Estanciero, who owns hundreds of square leagues of the surrounding country, but now tenanted by his manager, a superior sort of half-breed Spanish Indian, with his family. There was the huge square outside wall without windows of any kind, one arched doorway, and the inside house or houses built against the outer wall and facing into a patio—a most Moorish-looking place. Truly the occupation of Spain by the Moors has left its deep markings; they extended across to the New World, influencing to-day even the customs of the Indians of Spanish South America.

At Negra Muerta our road turned out of the valley to the westward, with Cochinoca and Rinconada as its objective. Cochinoca was settled from the western coast, and is one of the oldest settlements in Argentina. It is now a small trading station, almost lifeless, a mere collection of a few houses built of stone slabs and mud mortar, two churches, and a few huts, all nestled close together on the upper western slope of one of the chains of hills that intersect the plateau from north to south. Near Negra Muerta a few porphyry dykes crossed the country, and the older sandstones began to appear from amongst the very recent sedimentary deposits general hitherto. We were then about 11,000 feet above sea-level, and the trees were becoming very stunted, and vegetation more sparse. Five or six miles of travelling up the bed of a valley coming in from the westward brought us on to a treeless plateau some 12,000 feet above sea-level. This plateau extends some 250 to 300 miles from north to south, and is 50 to 60 miles wide. It is intersected by numerous small hills, singly or in chains, and by ranges of mountains, all running in the general direction of north and south. Where we entered the plateau, on its eastern side, sandstone rocks, very much foliated and twisted, were everywhere apparent; but as the tableland was crossed in a westerly direction, the hills jutting up from the plain, like mountains from the sea, were found to be of slate formation.

It cannot be said that there are any important rivers on this plateau. There are some minor rivers and dry river-beds that become torrents in wet weather, but these generally terminate or flow into large shallow flat lakes, completely dry in winter. Sometimes in winter there are places where the water remains in low-lying swampy ground, and these swamps were literally alive with aquatic birds—bright-plumaged flamingoes, geese, swans, wild duck of many species, and cranes, herons, and long-necked wading-birds of great variety; in summer time, when the depressions are full of water, they are remarkable for the numbers and variety of aquatic bird-life. It was on the edge of this plateau that I first saw the wild vicuña grazing in small herds like deer—very timid, and rarely approachable closer than 700 to 1000 yards. Huge herds of tame llamas were grazing like cattle on the plains. The sky was clear, blue, and cloudless, and occasionally a condor, like a black dot, moved across the line of vision. The locality is pretty well mapped, and the natural features shown may be taken as fairly correct, but without some description of the rivers and lakes, the information on the maps may be very misleading. As a rule, from which I saw no deviation, the rivers shown to run into inland lakes do not flow all the year round, and the inland lakes are not lakes at all except in the wet season; in the dry (winter) season they are either dry plains covered with fine grasses and rushes, or dry clay-surfaced areas crusted with salt, magnesia, borax, or some other of the alkalis. For instance, the "Laguna del Portezuelo," shown as a lake some 60 or 70 miles long, and 18 or 20 miles wide, is in winter a grazing-ground for sheep; its surface seemed as flat as a billiard-table. I rode across its centre and along much of its length. A few scattered habitations were built above the wet season high-water mark of its shore; the dwellers in these had difficulty to find enough water in the winter for their domestic requirements. The same winter dryness existed on the "Laguna de Guatayoc," and the other salinas to the south; but on them the saline deposits took the place of the grasses of the more northern "lagunas." In the south the glistening white deposits and immense flat distances (in winter absolutely dry) gave all the appearance of inland seas. The mirage was almost always to be seen, and the reflection, and sometimes double reflection, of the islands in the lakes, or mountains at the back of them, could be seen whenever the sun shone on their surface. I have seen troops of vicuñas within one of these dry pans, fully 10 miles from the shore-line. They had come down the mountains for "salt-lick," and seemed to be standing in water up to their knees. I tried to stalk them, to get a skin or two, but they vanished into the mirage, and when I followed to where I first saw them, their hoofs had barely made tracks on the dry earthy crust of the alleged lake.

THE GOVERNMENT AERIAL RAILWAY IN COURSE OF CONSTRUCTION FROM CHILECITO TO THE FAMATINA MINES, SHOWING FAMATINA MOUNTAIN, 21,000 FEET HIGH, 25 MILES DISTANT.

The plateau seemed to be very sparsely inhabited; once or twice in a day's journey something in the distance looking like a boulder turned out to be a human habitation—a wretched structure of mud and grass, not 12 feet square and 6 feet high. Generally attached to such habitations was a corral or large yard, with a sod or mud wall, into which the llamas or sheep were herded at times, and in some places herded every night near mountains or broken country where pumas are. The inhabitants, as far as I saw them, both on the plateau, in the mountains on the plateau, and in the settlements, were about equally composed of three classes. The first, dark swarthy men and women—pure-blooded whites of Spanish extraction; the second, pure-blooded, straight-haired, fine-featured Indians, something like the North American red man; and the remaining one-third, a mixture between the two races. All spoke Spanish, which seemed to have entirely displaced the native languages. Their religion was nominally Roman Catholic; in the larger towns it was strictly so, but in the smaller settlements it appeared to be a mixture between the Roman Catholic ritual and some rites of a long-forgotten Indian creed. All the men, from the peons to the highest in the land, were delicate, refined, and courtly in manner, and hospitable to an extraordinary degree; yet when it came to paying those who expected payment, they were by no means modest in counting up the bills. The people in the settlements were generally small traders, who bought skins and gold, and had a few soft goods, hardwares, groceries, and spirits for sale—all of fifth or sixth rate quality, and the keepers of these stores seemed to lead a very listless life. I cannot say that the people outside the settlements followed any industry; they seemed contented to live, with a minimum of intelligent existence, bodily comforts, and food. On the plains, the children tended the sheep and llamas; the women pottered about the huts, or wove cloth, or made garments, and did such meagre cooking as was indulged in; the men did not appear to have any special employment—they usually seemed to be occupied with squatting in the sun, smoking cigarettes. Every one who has read the histories of the Incas has marvelled at the tales of the native runners, who were a feature in the civilisation of that period; some of this race of men still remain. I have often had a telegram delivered at the station 40 miles distant from where sent, and an answer received and brought back by the same man, all, including the journey of 80 miles, not occupying more than eighteen hours; the man was well content to receive two Bolivian dollars, or three shillings in English money, for the service. I saw a man who delivered a message 200 miles away and brought an answer back, covering within six days and nights 400 miles. As he did this work for a native, his charge was five Bolivian dollars (seven and sixpence English money), out of which he provided his own food. All the men were runners and walkers—even the little children could run up a mountain without any apparent trouble.

The air seemed to be exceedingly soft, grey, and heavy in character, and I feel certain it would grow alfalfa (lucerne) and cereals, such as oats and the hardier kinds of cold country grain, most excellently. During my entire journey in the north, covering over 1000 miles, I did not see one square yard of cultivation. The altitude of this plateau prevents a luxuriant vegetation. Coarse, spiny, rush-like grasses, with finer grasses hidden amongst them, appeared to thrive at heights up to 12,000 feet above the sea; above 12,000 feet the grasses gradually disappeared, and shrubs began to take their place; at 15,000 feet there were only a few shrubs; at 17,000 feet nothing but bare stones—even the mosses, lichens, and lower forms of vegetation had entirely disappeared—and yet I have seen troops of vicuñas on these barren stones. Travel across these lands is more pleasant in winter than summer. In lat. 22° to 23° S., even at 12,000 feet above sea-level, although very cold at night, the sun was pleasantly warm during the greater part of the day, and except on grey days, when there was a wind storm, it was quite exhilarating to ride across the country. But in summer the sun beats down pitilessly, and the heat and dust are very disagreeable, and very frequently rain and snow storms are encountered.

A TROOP OF LOADED LLAMAS CROSSING A PLATEAU (ABOUT 14,000 FEET ABOVE SEA-LEVEL) IN SOUTHERN BOLIVIA.

On the western side of the plateau, on the Sierras de Santa Catalina, more sheep appeared to be grazed than on the plains; it was not uncommon to meet three or four times each day flocks of from 150 to 200, generally tended by an Indian child about 2 feet 6 inches high, clad in rags. As far as I could learn, these sheep were grown and used mostly for food, their wool being taken from the dead pelt; I did not hear of any wool being sent out of the country. The llama, too, is never shorn; their wool drops off in great bunches whenever it has attained its full length of staple—some 8 or 9 inches. The llamas are bred for pack-animals, and they are also killed and eaten. I did not taste any, as I was told the flesh was very rank. All I saw killed (animals as big as a red deer) seemed lean, sinewy meat without any fat; they fed chiefly on a coarse shrub called "tola,"* which grew in higher altitudes than grass. I have seen the llamas 16,000 and 17,000 feet above sea-level, apparently quite happy, and thriving well on tola and other coarse and strong-smelling shrubs. The value of the animal before being broken-in for packing is not very great. One of the mine-owners I knew bought a troop of some twenty animals to kill for meat for his workmen, and the cost, worked out into English money, was about three shillings and threepence per head. The wool of these animals is sometimes pulled off in large handfuls when it is rotten and ready to drop, and it is also cut off the dead pelt. The Indians plait it into soft ropes for tying on packs, and sometimes spin it into thread and weave cloth of it, but the llama cloth is not esteemed as highly as cloth made of sheep-wool. The natives say it will not stand the same wear as sheep-wool cloth, and that it is brittle; but to my mind this is not to be wondered at, for no care is taken to cultivate the wool. There ought to be an opening for an industry in cultivating and supplying this wool to European markets. Something, too, might be done with vicuña wool; it was common to see 200 to 300 vicuñas each day. Though very timid and wild, they are easily driven; they will not cross a pack-thread stretched along the ground. The wool of the vicuña is very highly esteemed; the equivalent of ten to twelve pounds sterling is often paid locally for enough of the choice wool to make a shawl or poncho. The Argentines, the Bolivians, and the Indians of both countries organize huge drives; in each drive hundreds of vicuñas are killed with "boleadoras," lasos, sticks, and stones. It may be safely said that no man wears any vicuña cloth made of wool taken from a living animal. It is the timidity of these animals, and their extraordinary wariness, that alone prevents their extermination. The animals seen on the ranges and plateau were wild vicuñas and tame llamas, sheep, mules, donkeys, but very few horses, and no horned cattle. Of the smaller wild animals, large numbers of viscachas† were always seen in cliffs and steep rocky ground. This is an animal in size and appearance like the opossum, but the tail is not prehensile; although to be seen all day long, the animal probably does most of his moving about and feeding during the night, for his eyes are beady and protruding like night prowlers, and the whiskers or feelers are abundant and long, sticking out from 4½ to 6 inches on either side of the muzzle. The grey fox, of two sizes—one small and the other a little larger than a full-sized English fox—was frequently seen, and the "red" fox, a handsome black-and-tan animal a little larger than an English dog-fox, is met very occasionally. On all the high mountains the chinchilla used to be found, but they are now nearly exterminated. There was a rat-like burrowing animal all over the plateau and up the mountains; I have found their burrowings close together even above 17,000 feet high; in places their colonies were so dense that it was dangerous to ride fast over the ground. The animal is called the tucutuco, and the natives call the hole tucutucales.

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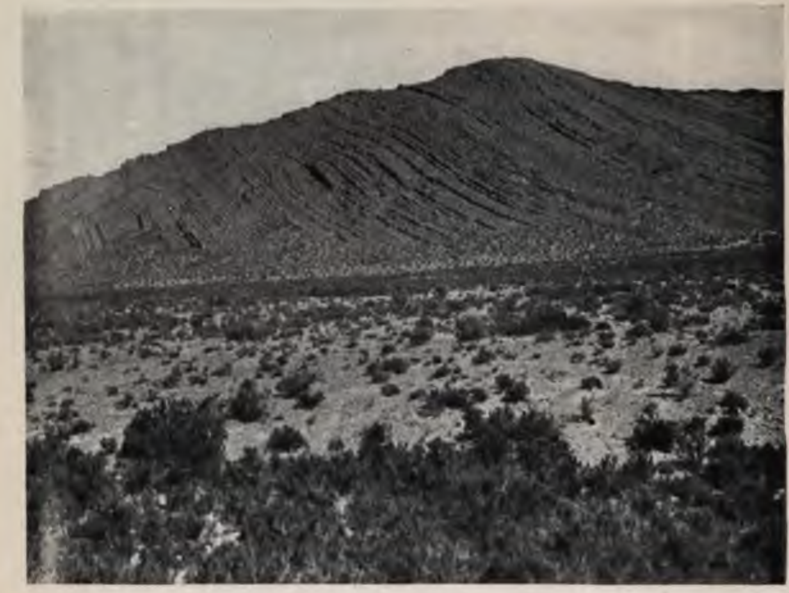
* Cobo, p. 486, *Baccharis Incarum* (Weold).

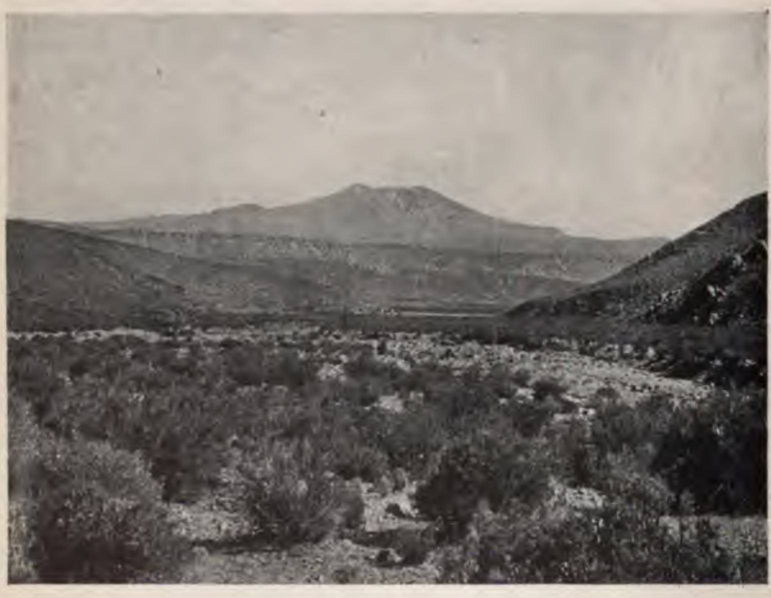
† (*Viscacha*) *Lagidium Peruvianum.*

AN ANCIENT SPANISH MINING VILLAGE, NOW IN RUINS (ABOUT 14,000 FEET ABOVE SEA-LEVEL). THE OLD CHURCH TO THE LEFT OF THE PHOTOGRAPH IS DATED 1735 DEPARTMENT OF RINCONADA, ARGENTINA.

Of the large tract over which I travelled, the part that interested me most was the chain of mountains running almost due north and south, generally named on the maps the "Sierras de Santa Catalina." These mountains pass south below the province of Jujuy, and continue north into Bolivia past the town of Santa Catalina on the Northern Argentine border. Over a stretch of country along that range, measuring as the crow flies some 200 miles, I rode backwards and forwards many times during my journey. The whole of this range, as far as I could observe, was composed of slates on edge; practically, it may be said that no other rocks exist, although in parts small quantities of granite or sandstones were seen; but primarily it is a slate country, tilted until the slates are almost vertical. For hundreds of miles these slates run in almost unbroken lines, with the regularity of ridges thrown up by giant ploughshares. My search for fossils was entirely unproductive; nor could I hear of any having ever been found there. Although at one time the strata forming the present mountains were below sea-level, it was disappointing not to find any fossils or traces of them in the rocks. As far as I could judge, the greater part of the surface of this range was gold-bearing; that is to say, in every gully or valley, where water runs in the wet season, there were traces of old gold-workings—in many cases very extensive indeed. I can say without exaggeration I have not washed a pan of dirt scraped from the hillsides without finding, at least, a colour of gold. Naturally the concentration for ages by wind, weather, and water over the surface of such country would cause the beds of the watercourses and gullies to be more markedly auriferous; but from what I could see, I am of the opinion that all the very rich patches of heavy alluvial gold contained in the creek bottoms and gullies that did not carry much water, had already been taken away, either by the people who were before the early Spaniards or by the Spaniards. I could find no record of any extensive workings being carried out by the people of the country since the Spaniards were driven out during the War of Independence one hundred years or so ago; but a good deal of fine gold comes down each year in return for the trade and merchandise sent into the country. The amount of work done by some people of the past was enormous; as to when the work was done, or by whom, the present inhabitants seemed to know nothing. Close to the town of Rinconada, to the north, a deep lead must have existed, for hundreds of acres of the hillsides are covered with the mullock-heaps from disused and fallen-in shafts sunk down to the gold-wash; these give evidence of systematic work of a most extensive character. The town is built on the side of the Santa Catalina range, about a mile away from and 500 feet above the edge of the plain. Between the town and the plain hundreds of thousands of tons of mullock (overlying a bedrock or false bottom 4 or 5 feet deep) have been turned over and washed, and no sign remains to-day of where the water came from to do such extensive washing. The people who live on the Santa Catalina range, for the greater part half-bred Indians, differ a little in their habits from the shepherds or graziers—dwellers of the plains—who live many miles away from any auriferous ground; here on the range the men, women, and children wash gold in the gullies and watercourses during each wet season, and in some places the men carry on continuous work during all seasons of the year. The work an Indian can do with a "batea," exceedingly fine as it is, may provide



ONE OF THE SPURS OF THE SANTA CATALINA RANGE (HEIGHT ABOUT 14,000 FEET ABOVE SEA-LEVEL), SHOWING THE TILTED SLATE FORMATION OF THESE MOUNTAINS. DEPARTMENT OF RINCONADA, ARGENTINA.



THE QUEBRADA OF AJEDREZ (ABOUT 14,000 FEET ABOVE SEA-LEVEL). DEPARTMENT OF RINCONADA, ARGENTINA. SHOWING THE MOUNTAIN OF GRANADA, 20,400 FEET HIGH, 25 MILES DISTANT.

for his small necessities, but it would not pay white labour to work on the same lines, therefore I consider the greater part of the range is valueless from the point of view of mining; it could not be profitably worked by modern machinery, owing to the thinness of the wash overlying the slate, and the absence of water to admit of work upon a large scale. Seeing so much alluvial gold spread over such a large area, at first I naturally expected to find gold reefs to account for the gold on the hillsides and in the valleys, and I searched for them continually; but I must candidly say, I have never ridden over such a large area of auriferous country and seen so few quartz outcrops. I am therefore obliged to fall back upon the hypothesis that the greater part of this slate country contains a vast quantity of fine auriferous quartz leaders, some of which may be perhaps not thicker than a sheet of paper; from the breaking down of these when the slate matrix weathers, the gold found in the valleys and watercourses is derived.

To the south, some 30 to 35 miles from the town of Rinconada, there is a very remarkable place known as Ajedrez. It is situated on the western side of the Santa Catalina range, and between the bottom of that range and the Oromayo river, which flows to the northward some 1½ to 3 miles eastward from the range. There a white sandstone country came in and abutted sharply against the dark tilted slates of that range, and the whole of the sandstone for an area of about 15 miles long and 1½ to 3 miles wide was covered with the broken and weathered slates from the range, that have weathered and washed down and flowed over the low ground between the range and the river, until hundreds of millions of tons of their detritus covered the sandstone with an alluvial wash composed of all sorts and sizes of slate stones, from rough, round-edged slabs 2 or 3 feet in diameter, 5 or 6 inches in thickness, down to little pebbles and sand, all cemented together with friable grey material. Fine "fish-scale" gold, worth over three pounds fifteen shillings per ounce, is contained in varying quantities in this wash. In some places the sandstone bed appeared quite bare, in other parts it was only covered a few inches deep by broken-up slates, in other places the wash was 15 or 16 feet deep, while occasionally it looked as if the slate wash were over 100 feet deep; and the area of this deposit was some 20,000 acres or so. The sandstone country was intersected by several rivers or mountain streams, that ran from deep ravines in the mountain range directly across it into the Oromayo river. If any of these ravines, or "quebradas," were followed down from the crest of the mountains, the tilted slate country of the Sierras de Santa Catalina could be seen in section where the watercourses cut their way through it. In some places the rocks rose on either side 700 or 800 feet high, and from there sloped away to a height of 1200 or 1500 feet to the tops of the spurs leading from the main range. The top of the range was in places fully 3000 feet above the Oromayo river. The most important of these ravines is known as Ajedrez, and it is from this that the vast tract of auriferous country takes its name. Down the Ajedrez ravine for a length of about 1½ mile, both sides of the watercourse were once closely built upon; the ruins are at present in a fairly good state of preservation, and must at one time have housed a population of between 2000 and 3000 people. High on the mountain-side, 1000 feet above the large building once used as a police depôt, or headquarters for officials (where the English engineers now working the place reside), there was another old village, with the ruins of a Spanish church. There were evidences of great activity in the immediate locality, for not only had a length of about 2 miles along the bottom of the ravine been turned over and washed, but the river-bed was one mass of old shafts, sunk to get down into the wash below. All round the ruined Spanish village and church, up the mountain-side, there were the remains of old workings. Very extensive remains of "acequias" or water-ditches followed the contours of the sides of the ravine, and led down into the river-bed where gold-washing was carried on; the tradition is that the bottom of the watercourse was turned over and washed three or four times. As the stream approached the plain several gullies joined it from either side, and in all of them there were remains of old buildings and gold-washings. The water from these gullies augmented the main stream flowing on the surface and below the stones and gravels, and here ceased all traces of the turning over of the river-bed or of shafts to get to the wash below. There was no cause apparent for assuming that the gold in the river-bed gave out, and it is logical to reason that the work stopped for want of means to deal with the heavy and increased water-flow. At any rate, there was over a mile of the bed of the watercourse before it joined the plain, and immediately below the very extensive old works, that may be considered as virgin ground. The quebradas of Anticuyo, Casa Mucha, Chirigoya, Coyaguima, and others—in fact, every quebrada extending from the mountain range down to the Rio Oromayo, and crossing the auriferous ground, contained extensive ruins of the houses of the old gold-washers. In almost all these places a small population, who had roofed some of the ruins, lived in them, and these people made enough for their wants by turning over, again and again, the often-washed ground. The old time gold-seekers only washed in the bottom of the watercourses, where the gold was concentrated and easy to obtain; they evidently had no means of dealing with the deeper ground that carried much water. The native inhabitants of to-day appeared to be similarly situated, for they only had small shovels and "bateas" (flat wooden dishes shaped like the Chinaman's hat pictured on tea-boxes). Not only were the same class of ruined stone buildings, shafts and heaps of turned-over tailings visible around all the old settlements, but the mountain-sides above them were lined and seamed with old acequias that at one time carried the water to the gold-washings. Truly there must have been great activity in the quebradas crossing the Ajedrez auriferous area, for the ruins of the settlements suggest that certainly not less than 4000 people must at one time have lived there. Although the ancient gold-washers gave much attention to this place, and picked the choicer places, it appeared to have been neglected for years; but now some English engineers of the Rinconada Company are working at Ajedrez with satisfactory results. They spent a thousand pounds or so in making new water-ditches and some sluices, and are ground-sluicing the auriferous slates and gravels overlying the white sandstone, and getting a net return of over one shilling and sixpence worth of gold for each cubic metre of stuff passed through the sluices.

THE DESERT OF RIOJA, ARGENTINA. OUTSIDE MR. W. A. TRELOAR'S QUINTA NEAR CHILECITO (ABOUT 3000 FEET ABOVE SEA-LEVEL).

The ancient workings in the neighbourhood were not confined to the easily handled slates and gravels of the river-beds of Ajedrez. The Indians talked so much superstition and weird nonsense about Cavaloonga mountain that I determined to visit it. They said "the mountain was the source of all the gold in the Rinconada hills and valleys; that it was the great 'mother of gold' of the district, and contained riches so great that, when once found, avarice would be dumb; but the place was haunted by the spirits of the dead Spaniards buried in the workings more than a hundred years ago." The mountain is one of the giants of the Santa Catalina range; it is about 16,500 feet high, and lay about 5 miles to the south of our camp. One long day from daylight to dark was occupied in getting to the top and back to camp. But it was one of the most interesting days I ever spent. The weather was clear and fine, and the climb was exhilarating; the views, once the summit was attained, were magnificent, for the top was the highest peak for 20 or 30 miles round, and a panoramic view for 100 miles or more could be obtained in every direction. All the vast plateau lay below us like a map to the east and north-east, with its rivers, river-beds, lake-beds, salinas, single hills, chains of hills, and mountain chains clear and distinct. Granada, lightly snow-tipped, 20,400 feet high, showed to the north-west about 25 miles distant, and seemed only 5 or 6 miles away; to the north, in Bolivia, in the main chain of the Cordilleras 50 or 60 miles distant, and from 20,000 to 23,000 feet high, Bonete, Estarca, and San Antonio, snow-capped, sparkling, and sunlit, looked like piles of molten metal. The Oromayo river and Ajedrez were just below us; the huge salinas in the province of Salta and the Puna de Atacama lay in the far faint distance to the southward. It was a glorious day and an incomparable view.

The ascent of the mountain was easy from the northern side. The formation was slate on edge, the greater bulk heavily decomposed; in some cases the highly decomposed slates were soft as running sands. On the way up I noticed a few quartz outcrops each over a yard wide; some were very unpromising in appearance, but two or three were of nice-looking stone. On the extreme summit of the mountain there were traces of old workings, very much fallen in and covered. About 150 feet below the summit of the mountain to the east there were three large dumps. The dumps must have represented mullock taken from galleries or shafts to the extent of over 100 yards long in each case. The dumps were composed of nothing else save soft slate; a few small pieces of quartz only were sparsely scattered on the surface, and almost every one had a nice speck or two of gold in it. It is reasonable to assume that any other gold-bearing quartz taken out of these workings was carried away. In each entrance to the workings a wall was built up on either side, and roofed over with dry-laid stone slabs to form a permanent entrance, and stone steps led down into the workings. But the dry rubble masonry of the passages was squeezed, and the passages narrow, fallen in, and impassable after 5 or 6 yards from the entrance. So I could not see any of the "buried treasure," nor the "bones of the dead Spaniards;" but undoubtedly very extensive works had been in progress there, over 16,000 feet above sea-level, in a past time of which, locally, nothing is now known.

After thirty-three days spent in travelling about the Rinconada district, my route lay southward. Towards the southern end of the Laguna de Guatayoc I passed the great borax fields of that locality. A very small part of these was being worked, but the visible evidences

A VIEW IN THE FAMATINA MOUNTAINS (ABOUT 15,000 FEET ABOVE SEA-LEVEL), SHOWING THE CONTOURS OF THE HILLSIDES.

THE BORAX FIELDS OF THE LAGUNA DE GUATAYOC (ABOUT 10,000 FEET ABOVE SEA-LEVEL). DEPARTMENT OF JUJUY, ARGENTINA. SHOWING THE BORAX DUG FROM CLOSE BELOW THE SURFACE AND PILED IN HEAPS TO DRY.

were immensely fascinating of the vast wealth of borax lying close under the crust of the salina; so closely at hand that nothing was required but to dig it up, and I felt loath to leave the place to continue my journey. Sometimes deposits such as these are spoken of as "borax mines," but are not mines in the ordinary sense of the word; they really present agricultural rather than mining problems. The vast flat earthy surfaces of the salinas beneath which the borax lay lost themselves in extreme distance or mirage, and to all appearance any one square yard of such places was similar to any other part. Perhaps it was so; but wherever the crust of the salinas in the locality of Tres Morros or Moreno had been dug into 12 or 14 inches deep, there lay masses of soft white round "potatoes" of borax, packed closely together to a depth of about 18 inches. The digging of the borax was just like the digging of potatoes, and the borax "potatoes" were stacked in rows on the ground, just as freshly dug potatoes on a farm are laid in rows; only an area of borax ground held perhaps five or six times as many borax "potatoes" as the same area of an agricultural field generally contains of the potato of domestic consumption. The lumps of borax varied from the size of a hen's egg, to pieces of 1 and 2 cubic feet in size. They lay close below the surface, and when broken were soft looking, like moist snow. After lying in rows on the surface, and subject to the intensely drying winds that swept over the plains at these high altitudes, the wet snow colour became white like pure dry clean snow, the lumps became hard, and the weight diminished more than half, by reason of the evaporation of the mechanically held water; the wind-dried borax then contained about forty-five per cent. of pure boracic acid. In some places these salinas were so rich in borax that it lay in unbroken seams 15 to 20 inches thick close below the earthy crust of the surface. For nine months at least of every year the borax fields are workable, and for the remaining three months they are either under water while the salinas are flooded in the wet season, or the surface has not dried sufficiently, and is too soft for men or vehicles to work on it or travel over it.

I followed the plateau southward for nearly seven days from Rinconada without any appreciable fall in altitude, until I wondered when the drop would begin, for the town of Salta lay some 8000 feet below our road. One awful day we travelled through a dry wind storm, which began about 10 a.m., and lasted into the evening, long after we reached camp. The wind blew continuously and gustily, with force that lifted stones as large as road metal, and carried such quantities of sand and grit that the day at times was almost dark. Fortunately, the storm blew in the direction we were travelling, otherwise it would have been impossible to move. The effect of the wind, dust, and grit on our eyes, and on the eyes of all the animals, was most severe, and its unpleasant results lasted for a day or two afterwards. On the seventh day out from Rinconada, a little south of Tres Cruces, at the height of about 11,500 feet, near some lagoons covered with water-fowl, on the eastern edge of the plateau, the road and a stream from the lagoons led into a ravine that speedily became a cañon; for although the road sloped steeply downwards every foot of the way, the top of the cañon on either side remained practically the same level, and the walls became very precipitous. The fall continued more or less regularly 50 or 60 miles down the "Quebrada del Toro," until Rio Blanco and the plains surrounding Salta were reached, where the altitude was about 4000 feet above sea-level.

After leaving Salta I next visited the province of La Rioja, a place remarkable for several reasons. For many years it had been considered the Cinderella of Argentina, but recently the Provincial and National Governments have endeavoured to provide facilities to take advantage of its vast natural resources, which are of sufficient importance to give promise that it will soon join the great wealth-producing provinces of Argentina. The province holds two important ranges of mountains, marked on only two or three of the published maps of South America. The Famatina range is the more important of the two; it is a spur of the main Cordillera, which it leaves at about S. lat. 26° 40′ and continues in a south-easterly or southerly direction to about S. lat. 30° 10′. The main peak, named Famatina (*fama*, "fame;" *tiene*, "it has"), is 6400 metres high (20,997 feet); it does not stand peak-like in any marked degree, for the chain itself close by is over 18,000 feet, and its surrounding peaks are about 20,000 feet above sea-level. Snow always lies in heavy patches on the more sheltered spots on the peaks and higher parts of the range, but no cap of eternal snow is there such as might be expected from the altitude. About 50 miles eastward of the Famatina range, the Velazco range rises from the plain, at lat. 28° 20′, like an island from the sea, and after continuing almost due south to lat. 30° (about 120 miles) disappears as suddenly as it began. The Velazco mountains are almost entirely composed of granite, and for the greater part of their course average a height of between 10,000 and 12,000 feet above sea-level; no peak much higher than the chain is noticeable in their contour.

Between the Velazco and the Famatina ranges lies what is known as the desert of La Rioja—a wilderness of stones, cacti, dry spiny things, with stunted shrubs, and forests of timber, all guarded by thorns as sharp as lancets. There are no lakes in this locality, and, indeed, no rivers. To understand one of the reasons of this it is necessary to explain the geological conditions, the main features of which are similar in every case, whether they refer to high mountains, or only little hills a few feet above the surrounding plains. At one time the surface of the country must have presented high ranges of mountains with sharp peaks and sharp chains of hills, all with deep-pointed valleys between. But deep-pointed valleys no longer are there; for, being a land where great differences of temperature, high winds, and other destructive elements were constantly present, the mountains and hills weathered, and filled the steeply sloping valleys level with the products of decomposition, and the running water was not strong enough to move them away. To-day comparatively level plains surround all the hills and mountains, and these present straight, hard, torn, and jagged outlines—the spurs with fine razor-backed edges, and the summits like sharp needle-points. There is practically no clay in the locality, and the soil of the valleys is highly porous. In every main valley coming from the mountains there is something in the nature of a mountain stream, that may follow its tortuous bed for 10 to 20 miles in length until it eventually reaches the plains, and then assuredly, after 2 or 3 miles are traversed, it loses itself completely. But it is almost certain that underneath the large stony beds of the valleys leading from the main chains of mountains, there flows somewhere a constant stream of water. Though the country generally is deficient in rainfall, there are certain seasons of the year when rain falls heavily and frequently. There are falls of snow on the higher mountains, but the winds are usually intensely dry, so it frequently

THE FAMATINA MINES, SITUATED FROM 13,000 TO 17,000 FEET ABOVE SEA-LEVEL, DISTANT FROM CHILECITO 25 MILES. THE TERMINUS OF THE GOVERNMENT AËRIAL RAILWAY WILL BE IN THE BOTTOM OF THE VALLEY, ALONGSIDE THE HOUSES SHOWN IN THE RIGHT-HAND CORNER OF THE PHOTOGRAPH. NOTE THAT THIS PHOTOGRAPH WAS TAKEN FROM A POINT ABOUT 19,000 FEET HIGH.

happens that a heavy fall of snow one day will before the next have completely disappeared, without adding any perceptible volume to the flow of the water in the streams. The headwaters of most of the streams are black, blue, green, or yellow in colour, and so highly are they impregnated with the salts of copper, silver, and other metals, that even tired mules, without water for two or even three days, refuse to drink of them. It is only far away from the sources of these streams, after they have been augmented in the lower hills by pure water-flow from hundreds of gullies, that the bitterness of the water becomes so diluted as not to be noticeable, or deleterious to animal or vegetable life. Occasionally heavy torrents of water pass down the valleys carrying rocks and stones with them, but for almost all the year they are dry, except for small streams that find a channel amongst the dry rocks and stones covering their wide surfaces. The effect of the occasional torrential waterflow was very marked, though only noticeable from a distance, and more particularly from some neighbouring mountain-top. Seen from either point of view, it always seemed as if from out of each ravine a mighty river were sweeping, eddying and roaring into the main valley, carrying everything before it; and yet, these places were only dry, arid, motionless, stony wastes.

The rocks of the foothills and lower ranges of Famatina are chiefly granite, and very remarkable amongst them are the conical hills of rosy-red iron-stained granite, looking like piles of bright red rust poured from some overhead shoot on to the plain, making a strong contrast to the chocolate-brown-grey background of the foothills. The grey granite rocks continue up to the height of about 10,000 feet, where slates begin. The slates are then continuous almost up to the peaks of the Famatina range; occasionally porphyry dykes, a little limestone, and some conglomerate rocks occur, but slate and metamorphic slate are the typical rocks of the Famatina range, and also of the Mejicana and other of the principal spurs that lead down from the main range. In climbing near to the summit of Famatina, at an altitude of between 19,000 and 20,000 feet above sea-level, I noticed that grey and a little rosy granite covered the surface, but whether these rocks extended to the top of the peak of Famatina I am unable to say, because I turned to the southward on to one of its neighbouring peaks about 20,000 feet high; but even there slate was the prevalent rock. I could not find any fossils, nor did I hear of any having been found in the locality. The rapidity with which the mountains weather and break down, both in La Rioja and in the northern provinces I journeyed over, is one of their most striking features. The sides and tops of the mountains are almost always covered deeply with a sheet of broken stone moving imperceptibly into the valleys. It moves so fast that it buries and blots out, almost like a fall of snow, any works which man may make on the hillsides and leave neglected for a few years. I have even seen entrances to tunnels buried and almost invisible after having been abandoned for less than a year. In all the slate formations the disintegration proceeds with very great rapidity, and the granite also weathers quickly.

The Indian has almost entirely disappeared from this place, and the inhabitants are mainly the descendants of the early Spanish settlers, who peopled the country from the west coast; and since the railways have been built into North-West Argentina, a large population of Europeans has settled there.

The animal-life in the mountains of La Rioja differed materially from that described in the northern part of my journey. The guanaco took the place of the vicuña, and no llamas were to be seen. The tucutuco was not there, neither was the chinchilla. Herds of deer were in the valleys more remote from settlements, at altitudes between 3000 and 10,000 feet. There was also a large long-legged hare, or what is called a hare, but not having killed any of these animals I am unable to describe them. The large grey fox and the small grey fox were common, but the black-and-tan fox was very scarce. Mules and donkeys were used mostly as beasts of burthen; the horse was also used, but was not so useful in the mountain. There were many horned cattle, chiefly fed upon artificially grown alfalfa (lucerne). Sheep and goats were plentiful; these usually grazed upon what they could find edible and unprotected.

THE RIOJA DESERT RECLAIMED. MR. W. A. TRELOAR'S HOUSE AND GARDEN NEAR CHILECITO.

Bird-life was not much in evidence. Occasionally pigeons were seen on the desert, and a few doves on the desert and in the hills up to about 5000 feet; also in the hills a green and red parrot, nesting in holes, in the earth banks of cañons and rivers; a colony of them made a noise like young rooks in an English rookery. Now and then a brace of partridges were flushed; these were the long-necked, long-billed variety common in South America. Few duck or water-fowl were seen; occasionally a couple of duck came down on to one of the sweet-watered mountain streams. The carrion hawk and the vulture were very commonly seen, and occasionally the condor; but this bird is becoming scarce, owing to the constant warfare that has been waged against it, its skin with the plumage on it being valued at about twenty to thirty dollars (thirty-five to fifty-two shillings English). High up in the mountains, at altitudes of from 12,000 to 20,000 feet, the calls of ptarmigan were continually heard, although I did not see any of them.

There was practically no vegetable life on the desert of La Rioja beyond cacti and thorny and spiny growths, hard, dry, and repellant. The trees sometimes grew as large forests, and were characteristic of the country and the vegetation—gnarled, rugged, and strong, grown into distorted shapes, but neither wide nor shade giving. The wood was dense and heavy, and of high calorific value, and burned with little ash. But even the limbs of the trees were all covered with sharp, lance-like thorns.

The most remarkable characteristic of this solemn, stern, and forbidding desert is that man can, when he chooses, turn it into as nearly an approach to a paradise as this earth anywhere affords; and water is the magic wand that with its touch produces fairyland. With water the extraordinary and immediate results produced are almost beyond the powers of imagination. The stories of the Arabian Nights, with the good and evil genii, are there in everyday garb. Water the ground, and a natural garden springs into life; cut off the water, and almost in a night it relapses into the grim, sterile, life-stifling desert. I can best instance the fertility of the land by describing one of the many oases which man has made in this locality, and take for example the quinta of Mr. William Alfred Treloar that lies close outside the town of Chilecito, at the foot of a granite ridge sticking out of the plain. There Mr. Treloar located himself some thirty-three years ago. He had travelled hundreds of miles over the dry thorny deserts to some mines in the Sierra Nevada near Chilecito, but there at the "Carrera" on the edge of the desert, among the dry barren shrubs, cacti, and rocks, he decided to make his home, for a little trickle of water had made some things green. From some 7 or 8 acres he gathered the stones to make his outside walls, and his house was built on others for its foundation, while its walls were of unbaked bricks and mortar made from the Earth's surface, puddled up with water, so little by little the home grew.

Broad spreading trees shaded the place; oranges, vines, peaches, figs, apples, pears, roses, lilies—fruit, flowers, vegetables, everything that one could conceive to be necessary for the wants and luxuries of man, seemed to be produced from these few acres. Gardens with shaded walks, and leafy bowers perfumed with thousands of flowers of all descriptions, amongst which butterflies and humming-birds flitted, whose hues were more dazzling than the blaze of colour from the flowers. Every tree he planted himself and saw grow, every flower or bower was grown or trained under his direction; small water-channels intersected the garden everywhere, and that and care were the secrets of the magic change from without the walls, where the dry prickly desert with its cacti and thorny plants and sand and stones disfigured the face of the Earth. The same desert stretched for thousands of square miles around this and similar oases; but throughout the vast desert the same bountiful plenty could be obtained were it treated in like manner to this garden, and the other gardens and vineyards of Chilecito and Nonogasta near by. For instance, in Mr. Treloar's vineyard, covering some 5 or 6 acres, a small tram-road ran up the middle. I asked what that was for, and when told that it was to bring the grapes to the wine-press, I wondered why they were not carried in baskets; but when I learned that off these 5 or 6 acres some 80 tons of grapes are gathered each year, I ceased to think of the tramway, and my wonder was turned to the marvel of the Earth's productiveness. Eighty tons were the average net yield, after house servants, farm and garden servants, and peons who drive troops of mules up and down the mountains with ores from the mines, had eaten their fill, and the house dogs, and the dogs of the servants and peons, and also a vast number of the little silver-grey foxes who crowded in yearly from all corners of the desert during the grape season, and birds who came from all places. There was enough and plenty for all of these, and then 80 tons besides. Natural prodigality pervaded the atmosphere surrounding Chilecito; wild asparagus of most delicate flavour flourished everywhere in the vineyards; peaches blossomed and produced lavishly wherever a peach-stone had fallen and was allowed to become a tree; poplars, and trees half poplars, half willows, shot up like beanstalks 35 and 40 feet tall in three or four years, and in twenty-five to thirty years grew to huge trees of unbelievable height, that broke cold and hot wind storms, and threw grateful but not stunting shade upon the vegetation near them. And in this wonderful atmosphere, with the surpassingly beautiful Velazco range 25 miles away in front of his quinta, Mr. Treloar tended his garden and followed his hobby. His business lay at the mines somewhere up near the clouds, at Famatina—indeed, I believe some of them are the highest mines in the world; down on the desert's edge was where he played and kept open house for all friends and visitors, rich and poor. Far over the desert, thirty years ago, he sent his ores to be carried to the port and to Europe, until, four years ago, the rail-head reached Chilecito, just on the other side of the ridge alongside which his habitation has been fixed.

Large tracts of desert in the locality have been reclaimed—cleared of thorns and stones and irrigated — and on these vine-growing flourishes; but the results so far are more excellent gastronomically than commercially. Up to the present Chilecito wine has not made the market it deserves in the Republic, and, as far as I know, Argentine wines have not yet found much place in the markets of Europe; but of all the very excellent locally made wine which I tasted in various vine-growing districts of Argentina, that grown on the desert of La Rioja was by far the most palatable.

The real industry of the department of Chilecito has up to the present been mining, and it is that which will probably bring the province into world-wide fame, and cause vine-growing and the general tending of the soil to follow in its train. This place Chilecito was settled from Chile during the time of the Spanish occupation, because of the richness of the Famatina mountains in silver, gold, and copper. Millions of ounces of silver have been taken from the Cerro Negro, that lies at altitudes of from 8000 to 12,000 feet above sea-level, close below the peaks of Famatina; and higher above the silver are the great copper-silver-gold mines of Famatina in the Mejicana spur. To these last the Argentine Government are now building the largest aërial railway in the world, so as to connect them with the Government railway at Chilecito. In the earlier days of the recent history of these mines, the ore was sent over the Cordilleras into Chile on the backs of mules; later it was carried for more than 300 miles across the deserts, either on mule-backs or in carts, until it reached the waterways of Eastern Argentine; and later still, after the big company railways had been built northward through the Republic, the Government pushed a mining railway westward, in order to tap the riches of the province. The recent history of the Famatina mines extends for some thirty years, and during that time ore to the value of over three millions sterling has been taken from them, and yet they may only be considered in their infancy. Records obtained from the smelters of 35,000 tons of ore treated in the local smelting works during the past few years show that the average value was £10 18*s.* 10*d.* per ton of ore. The Argentine Government expects that when the new railway is finished, about next October, connecting the mines with Chilecito, the district will take the lead in the mining industry of Argentina, and that a large population will follow, to work the mines, or take advantage of the extraordinary natural fertility of the soil.

My other journeys through Argentina were in places better known than these I have roughly sketched; nevertheless it is not an exaggeration to say that, outside the main roads and railways, very little is known, save locally, of that truly wonderful country overflowing with milk, honey, corn, wine, oil, and riches that the hearts of men desire.

Before the reading of the paper, the **President** said: I have the pleasure of introducing to the meeting the reader of the paper, Mr. O'Driscoll, who will give you an account of the very little-known part of the Cordilleras of the Andes, or rather two parts, one near the frontier of the Argentine Republic and of Bolivia, and the other somewhat further south. I will now ask Mr. O'Driscoll to address you.

After the reading of the paper:—

Colonel **Church**: Mr. O'Driscoll has this evening shown us views over some of the tramping grounds of my youth. He has gone a little further to the north-west than I travelled, but where he left the country to the north I went immediately northwards up the Rio Grande branch of the Humahuaca and reached Peru by the way of Bolivia. Well do I remember that river; I never want to see another like it. For 250 miles up its boulder-covered bed it was nothing but jagged rocks. You may judge a little of the character of the riding when I tell you I forded it on one day fifty-one times. Such is the character of the country that the river is hemmed in by lofty mountains such as have been shown you this evening. One finally emerges from the headwaters of the stream and reaches the tableland of Bolivia. All this country was a portion of the southern outpost of the Indian empire, and I am a little disposed to differ from Mr. O'Driscoll that all of its mines were opened by the old Spaniards; I think the Incas got a great deal of the copper that they used for instruments from that very district. Moreover, the slopes of these mountains were the scenes of many hot contests between the Inca army and the Chirihuano branch of the Guarani tribes of Paraguay. What we have seen to-night is a country which is destined to become an enormously productive mineral district. It is probably one of the richest copper fields in the world, and the fact that the Argentine Republic, with that energy which characterizes its people, is now turning its energies to its mineral wealth is a very good sign, and it must increase the prosperity of that wonderful land. It attracts attention almost equal to North America, and certainly, in proportion to its area, its million square miles ought to produce in varied products as much as any other million square miles on the surface of this Earth.

Dr. **Evans**: We are much indebted to Mr. Florence O'Driscoll for his graphic account of a journey through very interesting country. It is about fourteen years ago that I first met him very nearly in the centre of South America, close to the borders of Brazil and Bolivia. At that time he, like myself, was a new-comer in the South American continent, but he has made good use of his time since. He still, however, seems to find it hard to reconcile himself to the Spartan fare of the wilderness. I was especially interested in his account of the system of wire transport. There are many regions in the Andes, both of Bolivia and Peru, which can only be opened up by the use of that means of locomotion. I was also glad to hear of the progress of the railway northward into Bolivia, and I look forward to the time when we shall have a continuous railway service from Buenos Ayres to the Caribbean sea. All those interested in the South American continent look with envy on the great railway network of North America, and hope some day to see something like the same state of things in the south.

The **President**: We have to thank Mr. O'Driscoll for an interesting paper respecting the country which he has described most admirably both by his lecture and by his illustrations. The meeting will have noticed that he described two regions very distant from each other; the first being the Sierra de Santa

Catalina which I think peculiarly important from a geographical point of vi because here, or very near it, the three ranges of Peru become the one range dividi Chili from Argentina and running down into Patagonia, and that particular porti of the Andes is very little known indeed. This is the first time I have met wit traveller who has ever visited those heights of the Sierra da Santa Catalina, and, far as I remember, I know of only one who has ever gone over that country a traveller into Bolivia. There is an account of a young lady, living in the seve teenth century, who stole her aunt's scissors while she was in church in Sebastian in Spain, stole her keys, escaped out of a convent into a little wo and there turned her novice's clothes into a boy's clothes, went and hired her on board a ship, and went out to South America. She there entered as a priv in the Spanish army, did good service, and gained a commission as ensign. Th she had the misfortune to kill another gentleman in a duel—having killed th or four others before—and she had to run for it. She appears to have gone o that very pass, and to her great joy she saw two men sitting on a stone, and sure she would get some food from them, but when she got near she found th were both dead, with nothing in their pockets except money, which was no g up there. Then she made her way down to Tucuman, living on roots and and there she was most hospitably received by a Spaniard. But she began maki love to his wife; the Spaniard was furious, and she had to go. She was chased the infuriated husband, so she turned to the left and crossed the Sierra de San Catalina, all that time for hundreds of miles living on roots and *tola* and sm rodents. How she could possibly have gone over that country by herself is mo marvellous, but it is perfectly certain that she did so, because there is documenta evidence of the journey. Now, that young lady is the only person I have ev read of who has travelled by that Santa Catalina route to Potosi alone. I ne not relate the end of the young lady; and I only mention the story here to sho how very few persons have travelled over the route. I am sure we are deepl indebted to Mr. O'Driscoll for the admirable description he has given of it, an especially of that very rich mining region, and for the graphic way in which h has described to us the mountains and mountain district of Rinconada. I am su that the whole meeting will join with me in giving a cordial vote of thanks to M O'Driscoll for his paper.

REPORT ON THE WORK OF THE AMERICANIST CONGRESS AT STUTTGART.

By the PRESIDENT.

The Fourteenth International Congress of Americanists, under th presidency of Prof. Karl von den Steinen of Berlin, was opened Stuttgart by the King of Wurtemburg on August 18. Our Societ was represented by the President; and among geographers and travellers there were H.R.H. the Princess Therese of Bavaria, PHIL.D., Le Du de Loubat, Dr. Reiss, Dr. Baessler, Dr. Boas of New York, Count Ros of Stockholm, and the Count de Créqui-Montfort, all distinguished fo their American travels and researches. There were also present Dr. Haring, the Rector of the University of Tubingen, Prof. Hamy (Membre de l'Institut), Dr. Holmes, the Chief of the Bureau of Ethnology a

Washington, Prof. Seler of Berlin, Dr. Thalbitzer of Copenhagen, Dr. Yngvar Neilsen of Christiania, and Jonkheer L. C. van Panhuys of the Hague. Of the Spanish-American States, Argentina, Mexico, Peru, Chile, Bolivia, Ecuador, Guatemala, and Nicaragua were represented by delegates.

As the work of the Congress of Americanists embraces geography, as well as anthropological, historical, and antiquarian researches, it is right that our Society should accept the invitation to be represented at it, and that we should be furnished with a report on its proceedings from a geographical point of view.

Our Scandinavian colleagues called our attention to questions relating to the Normans in Greenland, and to the Eskimo. The point of Dr. Yngvar Neilsen's paper was to establish the fact that natives met with by the Normans in America, in the twelfth century, were Eskimos, and not Indians; and Dr. Fischer gave illustrations of the cartography of Norse discoveries in America. From Prof. Stolpe of Stockholm we had a paper on the Eskimo of North-East Greenland; and Dr. Thalbitzer addressed the Congress on the dialects and migrations of the Eskimo. Shamanism among the Chukchis was discussed by Dr. Bogoras of Moscow. These five communications, from their different points of view, represent a distinct advance in our knowledge of the history and movements of the Eskimo race. Dr. Boas, whose excellent work on Baffin island is well known, took part in the discussions; his own paper being on recent researches respecting the Vancouver Indians.

But little time was devoted to the North American Indians, but Mr. Currier, the Vice-President of the Catholic Seminary in Maryland, had a paper on the Indian languages in the United States. Dr. Sapper of Tubingen contributed an interesting paper on the Pokonchi Indians.

Jonkheer L. C. van Panhuys, an official in the Colonial Office at the Hague, and Dr. Schmeltz of Leyden, contributed papers on pictography in the Dutch Antilles, on the ornaments of the people of Dutch Guiana, and on a recent expedition into the interior of Surinam.

Mexico always has a large share of the attention of Americanists. At the present Congress there were seven Mexican papers on mythology, customs, sacrifices, hieroglyphic writing, and ornamental art; none having any bearing on geography.

As regards South America, most of the papers were of more general interest. Such was Dr. Meyer's memoir on the equatorial Andean region before the existence of man, which contained speculations on the glacial and inter-glacial periods with reference to the distribution of flora and fauna, and on the periods of volcanic activity in Ecuador. Dr. Baessler of Berlin contributed a most valuable paper on the ancient use of metals in Peru; and on his treatment of Peruvian mummies with all their outer wrappings, by means of X-rays, which enable him to see the skeletons and any other objects that are within the wrappings. This paper was illustrated by lantern slides. The archæological researches, made by Count Rosen, the companion of Baron Erland Nordenskiöld during his expedition on the frontier of Argentina and Bolivia in 1902, are very interesting. Unfortunately, Count Rosen was obliged to leave Stuttgart before the paper came on for reading, but he has had it printed in pamphlet form in English. There is clear evidence that the regions round Tarija and Jujuy were once very densely peopled.

The President's paper on the megalithic age of Peru was intended to raise some questions of geographical importance. He set forth the reasons for assuming the immense antiquity of an advanced stage of agriculture and of the domestication of animals in the Peruvian Andes. He arrayed all the evidence that the marvellous builders of the Tiahuanacu ruins near Lake Titicaca came from the south—from the once populous regions of Tarija, Jujuy, and Tucuman. He then quoted numerous authorities to prove that the ruins are of immense antiquity, that they were in the same condition in the time of the Incas as they are now. He set forth not only the excellence of the architectural workmanship at Tiahuanacu, but also the evidence that the builders were capable of recording great ideas by sculptured symbolical representation. Finally he showed that such work, and the movement of monoliths weighing 170 tons, necessitated the existence of a dense and well-organized population, requiring the provision of immense supplies of food. For Tiahuanacu is 12,930 feet above the sea, where corn will not ripen. The two geographical questions raised by the paper were the changes of levels of Lake Titicaca with regard to the site of the ruins, and the supply of food for a dense population living at 13,000 feet above the sea. The author ventured upon some suggestions to account for facts so difficult of explanation.

The President's paper was followed, on the same day, by a most important report on excavations at the Tiahuanacu ruins, by the Count de Créqui-Montfort, the leader of a French mission. In the course of his excavations the Count discovered an outer wall previously unknown, a stone staircase, vestiges of several colours on sculptures and pottery, and statues. The Count de Créqui-Montfort also communicated a report on the examination of a Peruvian necropolis; and gave some information respecting the little known country of Lipez and Atacama.

There were two more general papers, one on the myths and legends among the primitive people of South America and their dissemination, another on the actual state of exploration in South America and on a programme for the future. The latter subject is one which may well engage the attention of our own Society, for with the exception of the Antarctic regions, there is more unknown or little known land to be explored in South America than in any other part of the world.

Two interesting papers, one on the discovery of a globe of Gemma Frisius with the date 1537, five years earlier than Mercator's globe; the other, on the influence of magnetic variation on the cartography of America in the sixteenth century, must also be mentioned.

The Congress at Stuttgart has been a success, both with regard to its results and socially; and Prof. von den Steinen, and his supporters, are to be congratulated heartily on the good work that has been achieved. Much of the success was due to the efforts of the Count von Linden, and of the treasurer, Mr. Wanner. The number of Americanists present at the Congress was 380, number of papers read 40. It is understood that the next Americanist Congress is to be at Quebec.

DESCRIPTION OF AN ASTROLABE.

By S. A. IONIDES, B.A.

It is well known that the astrolabe is an instrument which dates back to ancient times. Its invention is ascribed to Hipparchus (B.C. 150), and its subsequent development to Ptolemy (A.D. 130) and the Arabian and Persian astronomers. A great advance in its use was due to Martin Behaim, of Nuremberg.* It continued in practical use for two centuries or more, till superseded by the quadrant, or sextant, and logarithm tables (for it combined the uses of both), at the beginning of the eighteenth century. It is said that examples are made in the East to-day for astrological purposes.

There are several books and papers describing the astrolabe. First, both in time and importance, is Chaucer's description in 1391. This is now made easily accessible in Prof. W. W. Skeat's edition (1894). It contains a full description of the instrument, and the multifarious uses to which it can be put, and Prof. Skeat has added notes and explanatory diagrams. In 1587, Robert Tanner (gent. practitioner in Astrologie and Phisick) published in London a work entitled 'The Travellers joy and felicitie; or A Mirror for Mathematics, Golden Gem for Geometricians, A sure safety for Saylers, and an Auncient Antiquary for Astronomers and Astrologians.' The first chapter contains a description of the astrolabe with diagrams, and thirty-one other various uses to which it may be put. In 1856 W. H. Morley published 'A Description of a planispheric Astrolabe made for Shah Husain Safawi, King of Persia,' which contains facsimile reproductions of a large Persian astrolabe in the British Museum, and of others, and gives a very full description of the parts. The issue was limited to one hundred copies, and is long since out of print. In 1894 Lady Huggins published a short article on the Astrolabe in 'Astronomy and Astrophysics.' It contains several excellent photographs and drawings of an oriental astrolabe, a historical summary, and several quaint references to its use in contemporary works.

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* The exact share to be ascribed to Behaim in the introduction of improved methods is matter of doubt.—[Ed. *G.J.*].

None of these books, and none of the papers to which references will be found in the short bibliography at the end of this paper, give any account of the theory of the instrument, and many discuss it almost entirely from the archæological point of view.

When, in December last, I was fortunate enough to come into possession of an astrolabe, Dr. H. N. Dickson suggested to me that it would be of interest to describe the instrument, and to give in a concise form some account of its theory and uses.

This astrolabe is inscribed—

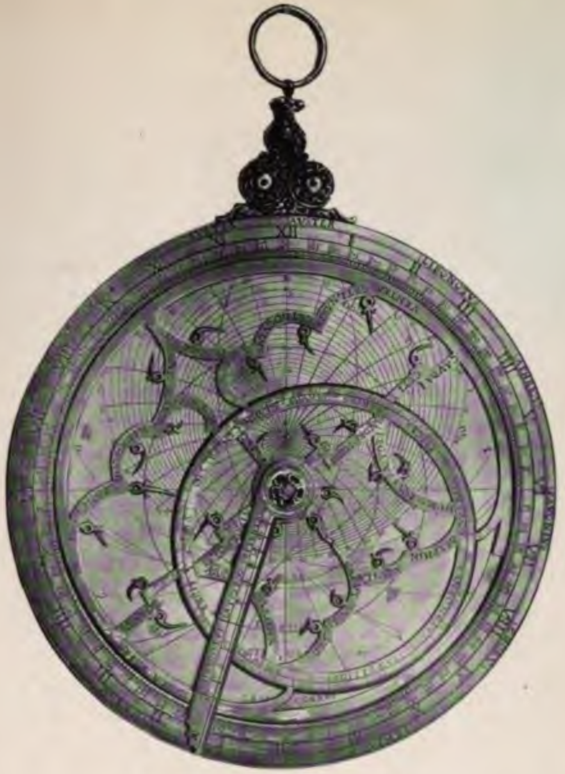
> "GEORGIUS HARTMAN NORENBERGE,
> FACIEBAT ANNO MDXXXVII."

The date is interesting as being six years before the publication of Copernicus' great work, 'De Revolutionibus Orbium Celestium,' in 1543. At South Kensington there is one, and at the British Museum there are two, by the same maker. No essentially different features have been noted in any of them. This description, while applying in particular to a Hartman astrolabe, is applicable to all in general, as the principles involved in all appear to be the same.

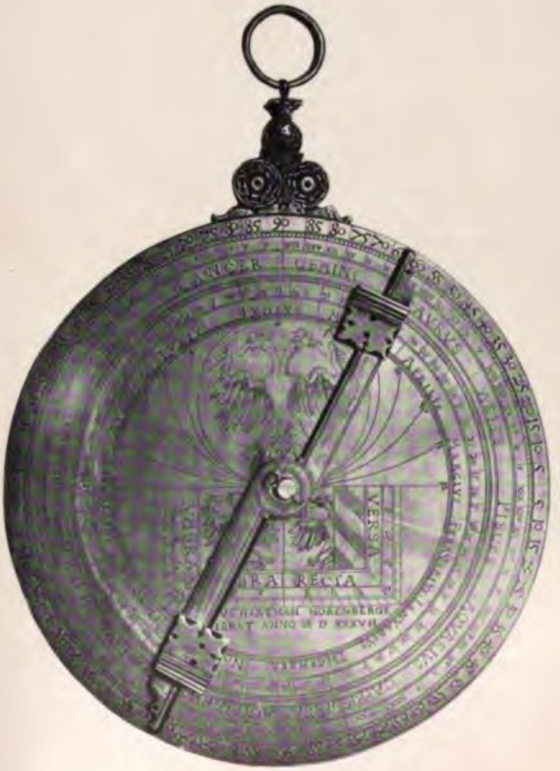
The photographs which accompany this paper show all the working parts of the astrolabe. The main part is a brass disc engraved with scales, and hollowed out on one side, the hollow being called the moder of the astrolabe; the instrument is held by a ring attached to the disc.

The separate parts are the alidade for taking sights, the "declination scale," the net, and the "latitude plates." These last are stored in the moder of the astrolabe, and only the upper one shows in the photo. The parts are pivoted on a brass centre, and kept in position by a split pin. On the brass centre and on the handle which holds the ring are engraved Tudor roses—the same being found in the South Kensington example—and this, taken with the fact that they were made in the reign of Henry VIII., and were found in England, suggests strongly that they were made for English use, possibly for presentation to some royal personage, or for use in the British Navy. The British Museum examples have roses on the handle, but not on the centres, one of which is obviously of subsequent manufacture.

On the back of the astrolabe are engraved in order, counting from the outside, a circle for taking observations, divided to single degrees, and numbered 0–90 from horizontal to zenith and nadir; next the names of the signs of the zodiac, each divided into 30 degrees; and then the names of the months and their divisions into days.



THE FRONT OF THE ASTROLABE.



THE BACK OF THE ASTROLABE.

given there to 1537. The results obtained by calculation and by direct reading off the astrolabe were then compared, and it was found that while some agreed within a degree of arc of declination, and a minute of time in right ascension, generally variations up to 2 or 3 degrees of arc and 4 or 5 minutes of time were met with.

Below the net are the latitude plates—in this astrolabe three in number, and engraved on both sides. The latitudes for which they are engraved vary from 39° to 54°, 3° separating each plate. The main part of each plate is a stereographic projection of a sphere. The stereographic projection possesses the property that all circles on the sphere are reproduced as circles in the projection. These may be considered in two series. First, a series of nearly concentric circles; these are circles of altitude or almucantars, ranging in size from the horizon, the largest, to a dot representing the zenith. The altitudes are given for every 2°, and the circle for 18° below the horizon; the twilight line is also given. Secondly, a series of lines passing through the zenith; these are azimuths. One of them which passes through the point of projection is a straight line, and represents the meridian. The azimuths are given for every 10°, and are numbered from east and west, thus practically corresponding to amplitudes.

On each plate are engraved three other series of lines.

First, the tropics of Cancer and Capricorn, and the equator.

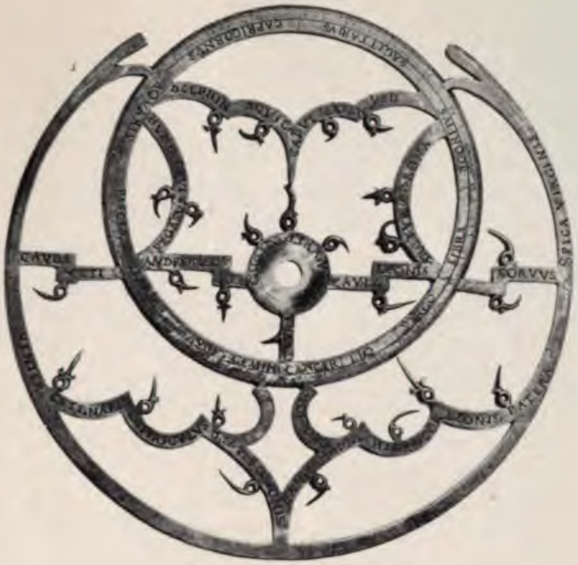
Second, twelve lines radiating from the intersection of the meridian and the northern horizon, and numbered I.–XII. According to both Chaucer and Tanner, these give the division of the heavens into twelve houses, "for divers astrological judgments." Prof. Skeat gives examples of how the equations of the houses were worked out.

Third, 12 lines marked 1–12 in the opposite direction to the foregoing. Segments of them only are given between the tropics of Cancer and Capricorn. They are stated to be the circles of unequal or planetical hours, or one-twelfth part of the time between sunset and sunrise, the division of the night in common use in early times. Pictorially they seem to represent the western horizon getting flatter and then curved in the opposite direction till it becomes the eastern. An account of them is given in Chaucer. The last two sets of lines cut the equator at equal intervals.

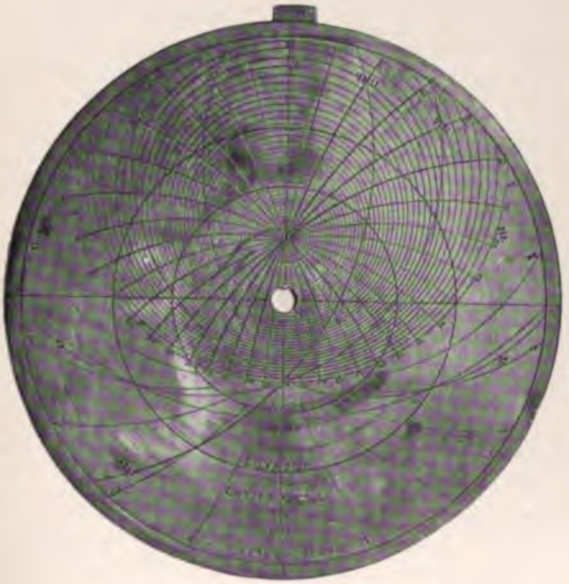
The practical use of the astrolabe may probably be best explained by taking imaginary examples and working them out, both on the astrolabe and by the ordinary methods now in use, the principles involved in both cases being identical.

To find the Latitude by Meridian Altitude of the Sun.—On October 19 the meridian altitude of the sun was observed to be 26°.

October 19 corresponds on the back to "Scorpius VI.," and on the front (see photo) the declination of the sun on that day was 13° S.



THE NET.



LATITUDE 51°.

Hence M.Z.D. = 64°
− decl. S. 13
Latitude 51°

The result could be tested by placing the correct latitude-plate in position, and putting "Scorpius VI." on the meridian. A similar calculation would be necessary in the case of a star, and the modern method is, of course, precisely similar.

Time by Altitude of the Sun.—On July 1, in lat. 51° N., the altitude of the sun east of the meridian was found to be 38°. Now, July 1 corresponds to Cancer XVIII. (see back). So Cancer XVIII. was set to altitude circle 38°, and with the ruler the hour angle of the sun, *i.e.* local (apparent) time, at once read off as $8^h\ 10^m$ a.m., the hour angle being always measured westward, and hence requiring no subtracting.

Giving the sun on that day the decl. 22° N., by the ordinary formula, hour angle sun = $3^h\ 45^m$, or local apparent time $8^h\ 15^m$.

Time by Altitude of Star.—On October 19, in lat. 51°, the altitude of Procyon east of meridian was observed to be 27°. The pointer marked "Procion" was set to altitude 27°, and its hour angle could have been read off, if wanted, as $8^h\ 11^m$. This was not, however, necessary, as with the position of the sun in the ecliptic at that date known, viz. Scorpius VI., the hour angle of the latter, *i.e.* the time, was read off at once as $1^h\ 12^m$.

To compute the mean local time from the observation mathematically, the declination must first be known. Procyon on the astrolabe has declination 9° N. Then, applying the ordinary formula ('Hints to Travellers,' 8th ed., p. 157), the hour-angle star was calculated as $3^h\ 50^m\ 40^s$; this subtracted from 12 hours gave westerly hour angle $8^h\ 9^m\ 20^s$. To obtain mean time, the difference in right ascension between the star and mean sun must be subtracted from $8^h\ 9^m\ 20^s$. The result is mean local time. The same process exactly is performed on the astrolabe, only graphically instead of by figures.

To find the True Bearing of a Heavenly Body.—By the same setting that gives the hour angle of the sun or a star, the true bearing can be found. Thus, in the example with Procyon, its true bearing will be seen to be 22° among the azimuth lines, the degrees being measured as mentioned from east and west. Chaucer gives the means of finding the true north from such an observation. Take the altitude and set the net as shown, read off the true bearing, then set the alidade on the back to the same degree, *i.e.* 22°, and, holding the astrolabe horizontally, sight the star. The handle will then point north or south according to which end of the alidade is used.

If the heavenly body be on the horizon, its amplitude is obtained at once; thus, in the photo the amplitude of Hydra Cor is 7° S. of E.

To obtain the true bearing from an observation of altitude, the formula given in 'Hints to Travellers,' p. 207, may be used. The bearing of Procyon calculated by this gives 20° 40′; so that the astrolabe can give fairly approximate, though not always a reliable, value.

To find the Time of Sunrise or Sunset.—Set the point representing the sun on the eastern or western horizon as required, and read off the time (*i e* hour-angle of that point).

To find Time of Sunrise, April 17, *Sun at Virgo III.*—The net is set as in photo, and time 5^h 6^m a.m. read off. The duration of twilight may be similarly estimated by setting the sun to the horizon and reading the time, and then to the twilight line and again reading. The difference of the two gives the desired result.

Chaucer gives a description for measuring the length of the "vulgar" day, by taking the interval in time between the sun crossing the eastern and western twilight lines.

The time that any star is rising, setting, or on the meridian may be found by setting that star to the desired point, and reading off the time from the known position of the sun. For the ordinary method, see 'Hints to Travellers,' p. 220. The altitude of the sun or star at any given moment may also be found simply. Knowing the position of the sun, set it to the time required, and read off the altitude of the heavenly body. The ordinary method of making this calculation will be found in 'Hints to Travellers,' p. 191.

Many similar astronomical problems may be very simply solved by means of the astrolabe, and a few only have been given which show the capabilities of the instrument.

All the examples worked out have been taken from the astrolabe set in the position shown in the photograph of the front of the instrument, so that the results can be readily checked.

In considering the theory of the astrolabe, it must be remembered that it was originally constructed in days when all the universe was supposed to rotate round the earth, and it may readily be imagined that it was at first intended to show the *real* motions of the heavenly bodies. The fact that we now know that the universe does not rotate around the earth does not upset the theory of the instrument. It only converts *real* into *apparent* motions.

The net is an equatorial projection of a sphere, probably intended to be the *primum mobile.* The plates are projections of the same sphere, from the same point to the same plane, only the axis of the sphere is inclined at an oblique angle to that plane. The combination gives on a plane, what would be seen of two segments of spheres, rather larger than hemispheres, set one inside the other, with axes inclined, and looked at from the other end of the axis of one of them.

It is interesting to note how well this projection shows the apparent motions of the heavenly bodies. As the net is rotated, any one star-pointer is seen to cross one altitude circle after another rapidly when far from the meridian, more slowly as it approaches it, reaching its highest altitude on the meridian, and receding in the reverse order.

Examples of the application of the astrolabe to ordinary uses have been given here, but for its many further uses, especially those relating to astrology, Skeat's Edition of Chaucer should be consulted.

The skilful design of the astrolabe is well worthy of note. Accuracy is not quite such a prominent feature, and one cannot be surprised that determinations of time at sea were often four or five minutes out, and that little reliance was to be placed on the resulting longitudes.

My best thanks are due to Dr. H. N. Dickson and to my brother, A. C. Ionides, for much assistance in the preparation of this paper.

Descriptions and illustrations of astrolabes have been found in the following:—*

Prof. Skeat's Edition of Chaucer (Clarendon Press), vol. iii. 1894.

W. H. Morley, 'Description of a Planispheric Astrolabe constructed for Shah Husain Safawi, King of Persia.' 1856.

Robert Tanner, 'A Mirror for Mathematics, etc.' 1567.

Archæologia, 1852, vol. xxxiv. p. 60. C. O. Morgan. It contains an abstract of Tanner's book.

Laussedat, 'La dessin topographique,' vol. i. pp. 35–40.

Transactions of the Bristol and Gloucestershire Archæological Society, 1887–8. Robert Taylor, M.A.

Astronomy and Astrophysics. 1894. M. L. Huggins.

Journal of the Royal Asiatic Society, 1904. H. J. Cowper.

RECENT DISCUSSIONS ON THE SCOPE AND EDUCATIONAL APPLICATIONS OF GEOGRAPHY.

By Dr. A. J. HERBERTSON.

It may prove useful to many readers of the *Geographical Journal* to present a very brief review of some of the more important contributions to geographical and educational journals, both home and foreign, dealing with the subject-matter of geography, and the value of the subject in an educational curriculum. It is necessary to discuss the content and method of geography before saying anything about its educational applications, for we must be perfectly clear about what we mean by geography and what is the specially geographical way of dealing with facts before we can profitably urge the importance of the former or the value of the latter to the schoolboy.

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* See also figures in the *Journal* for June, 1903. Further references which may be of use in tracing the history of the astrolabe and other old nautical instruments are given by Dr. S. Günther in the *Geogr. Zeitschrift*, vol. iv. p. 157, and by Admiral Markham in the Hakluyt Society Edition of 'Davis's Voyages.' See also Gelcich in the *Hamburgische Festschrift . . . Entdeckung Amerikas*, vol. i.—[Ed. *G. J.*]

What is Geography?

In a recent lecture Prof. J. W. Gregory * defines geography as "that branch of knowledge which describes the Earth;" and maintains that "it is a branch of knowledge rather than a science," that its subject-matter is "description drawn from observation;" and that it does not "search for underlying principles," nor attempt to discover ultimate causes. Few geographers will agree with this account of their subject. Prof. Gregory seems, from his school books as well as from his lecture, to believe that geography is physiography plus a descriptive topography which cannot quite be confined to pure description, but "must sometimes glide into explanations." He seems to think that to admit more than this involves joining the ranks of a mythical school of geographers, who consider that "what is not geography is not knowledge." It may be that Prof. Gregory has encountered men in the fresh enthusiasm of geographical conversion, which reveals to them a new Earth, and for the moment the dazzling wonder of the vision has obscured all other sights. For them "Earth's young significance is all to learn," and the geographer is its interpreter. Such enthusiasm is, however, only too rare, and any temporary distortion of the relationship of the sciences which it induces is a little price to pay for the fuller, truer vision which afterwards comes. We hope that there are many earth-struck youths in the southern hemisphere. There are too few in this.

We have to contend daily with the misconceptions engendered by many a dreary ill-spent hour at school or, in the more intelligent, by a confusion between that excellent introduction to science which in this country is called physiography, and geography. Physiography is a useful introduction to geography, as it is to the other branches of science of which it treats, and as systematized nature study it is an invaluable school subject. It is not geography any more than it is geology, or astronomy, or physics, or botany. We fear that it is not the deep emotion of geographical inspiration, but the confusion of physiography with geography which has spread abroad the notion that geographers consider geology, etc., branches of geography. It is hardly necessary to controvert this conception.† The man who makes such claims is not a geographer, for he has not yet attained to an understanding of what geography is.

If we turn from Australia to Germany, we find in such a work as Prof. Wagner's 'Lehrbuch,' ‡ used in all the universities, the definition of geography is based on the historical development of the subject as two-phased—one revealing the Earth as a special natural body with a variously shaped surface on which many natural phenomena, through orderly co-ordination, control the life of countless organisms, and the other showing the Earth as a dwelling-place of a highly organized and intelligent being, Man. The first phase is that of a natural science—Earth-lore—which is to be distinguished from other subdivisions by its constant investigation of the special relationships of natural phenomena on the surface of the globe. It is not restricted to an examination of the causes of the existence of simple organisms or processes, as is the case in many of the divisions of natural science, but strives to investigate the effects exercised by the various existences on other, or on the sum of the, contiguous phenomena. In the second phase, geography investigates man as dependent upon surrounding Nature, or as endeavouring to escape from this dependence. This is historical geography, and is the connecting link between natural science and history. For it, too, physical geography or Earth-lore is the basis and the extension, as it investigates the causes of the distribution of human phenomena. These may be regarded, as they have been from the days of Varenius, as general and special, Earth-embracing and regional. In Earth-lore the laws of the distribution of each and all categories of phenomena are examined for the whole Earth, without consideration of any special region. In land-lore or regional geography a single region is delimited from its neighbours, and its characteristics are determined by the total effect of the combination of all geographical elements within it.

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* 'The Teaching of Geography.' A lecture by J. W. Gregory. Melbourne, London, etc. Whitcombe & Tombs. 'The Austral Geographies.' Same author and publishers.

† Historically, of course, geology is a daughter of geography, but now that it is full grown with a family of its own, it has its own sphere of influence.

‡ 'Lehrbuch der Geographie.' H. Wagner. 7ᵉ Aufl., I. Band. Allgemeine Erdkunde. Hannover u. Leipzig: Hahn'sche Buchhandlung. 1903.

Dr. A. Hettner, Professor of Geography at Heidelberg, has recently written a valuable paper on the fundamental ideas and laws of physical geography.* He frankly confesses how much he has been hindered by the lack of clear ideas about the limits and conceptions of geography. Geography has at all times been originally a knowledge of different parts of the Earth, at home and abroad, and only the point of view from which the space has been regarded has altered with the time and with the bias of the geographer. In ancient Greek and Roman times geography was concerned on the one hand with purely mathematical conceptions, on the other with the description of human concerns. Nowadays geography is a consideration of the lands of the Earth, and of the Earth as a complex of lands comprehending both nature and man, and may be defined as "the sum of the facts which constitute the lands and landscapes, or, in other words, the specially varying conditions and occurrences of the Earth's surface considered in their causal relations." Into the detailed consideration of Dr. Hettner's paper we cannot enter in the present communication.

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* "Grundbegriffe und Grundsätze der physischen Geographie." A. Hettner, *Geographische Zeitschrift*, 1903.

Baron von Richthofen's views are discussed at some length in the February number of the *Geographical Journal.*[*]

In France the definition of geography as the study of the Earth in its relationship to man is the common one.[†]

In America no book such as that of Wagner or Dr. Mill's 'International Geography' has appeared, but the newer school books still show the influence of Guyot in defining geography as the study of the Earth as the home of man. Several papers have recently been published. In the year-book of the (American) National Society for the scientific study of education, Mr. Herbert Wilson of the United States Geological Survey discusses the relation of geography to other sciences.[‡] Here we find what we may term the organic conception of geography also expressed. He gently chaffs his fellow-geologists, who have recently become enamoured of the topographic side of their science, for confusing topography and geography, and for believing, as do some historians, meteorologists, and ethnologists, that the science of geography has ceased to exist. He quotes Dr. W. T. Harris's definition, which expresses Prof. Wagner's conceptions, "Geography unites the study of the natural elements, land and water, climate and productions, with the study of man's present conquest and use of the same." He suggests that geography, the oldest of the sciences, bears the same relationship to the natural sciences that civil engineering holds to the allied engineering professions. Prof. Davis has contributed three accounts of his views,[§] one of which has appeared in this *Journal.* He would expand the content of geography from the relation of Earth and Man to the relation of Earth and Life; "the cleared roadway of a colony of pillaging ants becomes as properly a subject of geographical study as a railroad that connects centres of human population." This leads to two divisions of geography—the inorganic environment which he terms physiography (which has now three different meanings thrust upon it), and the other, not the organic complexes, but the "responses which life has made to its environment," which he calls ontography. Ontography is more than ecology, for it includes "all the responses of organic forms to their physical environment, whether in physiological structure, in individual behaviour, or in racial habits." It is the element of relationship between physiography and ontography which constitutes geography.

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[*] "Triebkräfte und Richtungen der Erdkunde im XIX. Jahrhundert." Von Frhr. v. Richthofen. *Zeits. Gesells. für Erdkunde.* Berlin, 1903. See *Geographical Journal,* February, 1904 (p. 229).

[†] "La géographie a précisément pour objet de rechercher les relations qui unissent ainsi l'homme à la terre." "Les principes de la géographie moderne." M. Ardaillon. *Bull. Soc. Géog. de Lille,* 1901.

[‡] "The Relation of Geography to the Sciences." By H. M. Wilson. *The First Year-Book of the National Soc. for Scientific Study of Education,* Part ii. Chicago, 1902.

[§] "Systematic Geography." By W. M. Davis. *Proc. American Phil. Soc.,* vol. xli., No. 170, 1902. "The Progress of Geography in Schools." By W. M. Davis. *The First Year-Book of the National Soc. for Scientific Study of Education,* Part ii. Chicago, 1902. "A Scheme of Geography." By W. M. Davis. *Geographical Journal,* vol. xxii. October, 1903.

Just as the study of ecology has led botanists to a physiological classification of plants, which is of much greater value to the geographer than any morphological one, so we believe the study of biological and anthropological ontography, to use Prof. Davis's term, will help the geographer. The elements of anthropological ontography have been worked out, not merely in Ratzel's well-known books, but in a more inductive way in the writings of Le Play and his followers. Undoubtedly the possession of physiological (or ontographical) classifications of organic phenomena will lead to a new examination of distributions of organic life which will have a most stimulating effect on the geographer, especially if his chief interests are anthropological.

Prof. Davis is, however, not dealing similarly with his two divisions. He defines physiography as the total inorganic environment, but ontography is merely the *responses* in the organic world to the inorganic stimuli. While agreeing that it is highly desirable that such responses should be systematically investigated, and that the results will be of the greatest possible advantage to the geographer, we feel that geography is not completely defined when it is said to be the relationship between physical environment and the organic responses to it.

Prof. Davis seems to be approaching the definition of geography which has been given by Dr. Mill in the 'Encyclopædia Britannica' as "the exact and organized knowledge of the distribution of phenomena on the surface of the Earth." Dr. Mill further says that "the distinctive task of geography as a science is to investigate the control exercised by the crust-forms directly and indirectly upon various mobile distributions." This is a natural development of the definition of Dr. Keltie in 'Chambers's Encyclopædia'—that geography investigates the features of the Earth's surface and the distribution and mutual topographical relations of all which that surface sustains.*

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* Prof. Charles R. Dryer, in a suggestive paper on "What is Geography?" (*The Teachers' Journal*, Marion, Indiana), published since the above was written, says, "Geography has passed through a long period of development, and the end is not yet. In the early stage it was a description of the Earth. In the scientific stage which now prevails everywhere outside some schools, it is 'the exact and organized knowledge of the distribution of phenomena on the surface of the Earth.' In the third evolutionary stage, which is just beginning, it is 'the relation between the physical environment and the environed organism, between the Earth and its inhabitants.' This third and perhaps final stage of geography is based, 'not upon the doctrine of the adaptation of the Earth to man, but upon the more evolutionary principle of the adaptation of all the Earth's inhabitants to the Earth,' and the definition of the future may come to read something like this: 'Geography is the science which deals with the distribution of every feature and the environment of every creature on the face of the Earth.'" This states very clearly the ideas outlined by Prof. Davis, and shows that it is the Guyot conception expressed in terms of the control exercised by the environment on life instead of in terms of the providential adaptation of the environment to man's

The study of the distribution of any phenomenon presupposes the recognition and classification of that phenomenon. The individual rock, or plant, or animal is easily recognized; but no serious advance in geography was possible without a recognition of higher groups of organisms. Morphological, specific or generic, groups were not enough. As has proved to be the case in geology and meteorology, so in botany, zoology, and anthropology, the morphological groupings devised by the specialists in these fields of science have not been of the same value to geographers as other classifications based on physiological considerations. The old threefold classification of plants into tree, shrub, and herb was a better division for the geographer than the newer angiosperm and gymnosperm and cryptogam. It is this that Prof. Davis clearly feels in the case of the organic sciences, and he gives expression to his feeling in his definition of ontography.

The physiological grouping of organisms into plant, animal, and human associations is really what is required by the geographer, just as he must have a genetic classification of land forms, and a dynamic one of aërial and oceanic ones. These classifications are essential for geographical progress, and where they do not exist the geographer is diverted from his special work in order to investigate them. The meeting-place of the student of land, or air, or ocean, or plant, or animal, or man, with the geographer is in the examination of the distribution of these groups; but while each other specialist concentrates his attention on the distribution of the phenomena with which he is specially concerned, the geographer deals with the distributions of all. The fundamental facts of geography are these distributions. Starting from them, the geographer studies their relations, and discovers, what I think has not been seen with sufficient clearness in this country at least, that the higher organisms, the plant, animal, and human associations, are incomplete without some connecting framework, and that that framework is the physical configuration. Prof. Ratzel has done most to emphasize the importance of the space relations as the fundamental element in geography. In this country his books are still too little known. In his wonderfully rich and varied works, however, the point of view is almost exclusively that of the geography of man.[*]

More than this recognition of spacial relations in human geography is necessary, for each of these higher physiological groups is incomplete without the others. The higher organism is not simply the natural plant "association," or even the nation, but the other distributions

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needs. It is distinctly less general than Dr. Mill's definition, quoted as illustrative of a prior stage. Any scientific study of distribution must take into account problems of development.

[*] See especially 'Die Erde u. das Leben.' 2 vols. Leipzig, 1901, 1902. 'Anthropogeographie,' 2 vols., vol. i. in second edition. Stuttgart, 1899, 1891. 'Politische Geographie,' 2nd edit. Leipzig, 1903.

which exist within its confines are essential elements of it. The configuration is the relatively stable framework, the atmosphere and running waters the variable circulations which together determine the complex of organic forms including man, controlled by them all and more or less utilizing them all. Take away any one of these elements, and we are dealing with less than a geographical unity.*

These geographical units we may term natural regions, but we have to recognize that there are different orders of natural regions, from a highland glen to a mountain system. This is not the occasion on which to examine the major natural regions, of which there are some-fifteen types. The work immediately ahead for the geographer is the study of type natural regions, of all orders of complexity. The recognition of such natural regions and the knowledge of their characteristics are of the greatest practical importance to all men of affairs. It will afford a guide to action which they at present lack, and save countless expensive and heartrending failures.

This aspect of geographical work must also be dealt with in another article.

Geography applied to Education.

It is not commonly recognized that one of the most important applications of geography is to education. As long as geography was confused with gazetteer knowledge, it was natural that a head master should say, as some still do, that geography should be learned incidentally, or that a university committee should be advised that Bradshaw and Whitaker supplied sufficient geographical information for a student in a faculty of commerce. The persistence of this confusion probably explains the extraordinary omission of a systematic study of the possible theatres of war from the recent programmes for military cadets, whether at military colleges or at the universities.

While nearly every one admits that geography must be taught some time during school years, the problems of what geography is, and what parts of it are suitable for educational purposes, are too seldom discussed. All geography is not suitable for schools. There must be a selection of matter, and, further, an arrangement of it in an educational, not a logical scientific order. The gazetteer contents and the text-book order have both to be rejected. If we look at our present text-books we find several types, of which the comparative, with its ingenious but often superficial and sometimes most misleading comparisons, and the tit-bits, with its brightly written, interesting paragraphs of information tacked on to the main statements, are the most popular. Both have done good service in altering geography from a pepper of place-names to a subject which has at least some slight claim to be fit for educational nourishment.

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* Prof. Vidal de la Blache, one of the chief inspirers of the geographical renaissance in France, has expressed this idea in the preface to his atlas (Paris, Colin): "La géographie a donc devant elle un beau et difficile problème, celui de saisir dans l'ensemble des charactères qui compose la physionomie d'une contrée, l'enchaînement qui les relie, et dans cet enchaînment une expression des lois générales de l'organisme terrestre."

Most text-books and most syllabuses are divided into two parts—a general and a special; a so-called physical and political geography, but at present too often merely a physiography and a more or less gazetteer-like geography arranged according to political subdivisions. In some programmes these two parts are marked as alternatives for examination, and teachers most interested in educational discipline choose the former, while utilitarians select the latter.

The problem of text-book order, however, is quite a different one from that of the teaching order, unless the teacher is to abdicate his functions and become a mere "recitation" master, as the Americans so aptly term it. The order of presentation of geographical facts will vary with the position of the school, the experience of the pupils, and also with the interests of the master. It is important not to be dogmatic about this, but to leave as much freedom as possible to the teacher, once it is clear that he understands the subject.

In one of the last papers written by him, the late Mr. Rooper classified the various methods of dealing with geography in schools. This forms a useful guide to those beginning the study of the problem.[*] Many books and papers have been produced, more particularly in Germany, reviewing all or suggesting new methods. It is impossible to summarize them in this article. The titles of some are given below.[†]

In our own country many suggestions have been made, of which the most authoritative are those on drawing up syllabuses in geography prepared by Mr. Chisholm, Mr. Mackinder, and Mr. Rooper, and issued by the Royal Geographical Society.[‡] At many of the annual meetings of teachers' associations papers have been read both by teachers interested in geography and by geographers interested in teaching, and have given rise to much discussion. Among them, two addresses by Mr. Mackinder[§] have done much to combat the practice of planning separate courses in physical and political geography. In one he emphasizes the importance of the regional conception, and this has formed the theme of several papers mainly by his pupils.* In the other he traces a method of gradually specializing the geographical teaching from that of home lore or nature study.

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[*] "Methods of Teaching Geography," T. G. Rooper, *Geographical Teacher*, vol. i. No. 1, October, 1901.

[†] "Zur Methodik des erdkundlichen Schulunterrichts," H. Fischer, *Zeits. Gesells. Erdk. zu Berlin*, No. 2, February, 1902; "Geographical Text-books and Geographical Teaching," M. K. Genthe, *Journal of Geog.*, vol. ii., 1903; "Ziel und Methode des geographischen Unterrichts," Langenbeck, *Geog. Zeits.*, vol. ix. No. 2, February, 1903; "Geography in Germany," J. R. Smith, *Journal of Geog.*, vol. i. Nos. 9 and 10, November and December, 1902; "Geographischer Anzeiger" (Gotha), *passim;* various syllabuses which have appeared in the *Journal of School Geog.* and its successor the *Journal of Geog.;* and most fully in Dr. C. Gruber's "Geographie als Bildungsfach," Leipzig, 1904.

[‡] 'Syllabuses of Instruction in Geography.' R.G.S., 1, Savile Row, W. 1903.

[§] "Geography in Education," *Geog. Teacher*, vol. ii. part 3, October, 1903; "From Nature Study to Geography," *Ibid.*, vol. ii. part 5, June, 1904.

Another set of recent papers deals with practical work in geography and its educational value. It is not necessary to discuss this question in detail, as a special committee of the British Association is preparing a report on the subject, but the titles of a few papers may be given.†

What impresses one in the majority of these papers dealing with geography in schools is that the course is planned as if geography was a subject quite unrelated to others, and to be taught independently of them. This gives some validity to the argument of the ordinary head master who says the school time-table is already too full and complicated for him to think of altering it by further recognition of geography. Schoolmasters, however, will have to face the problem of replanning their time-tables, not in order to include the maximum number of separate subjects, but to permit the maximum co-ordination and the least possible separation into isolated subjects. It will be necessary for them to pay much more attention to classifications of knowledge than they have hitherto done. A rational system of intellectual education must be based on a sound classification of the sciences grouped according to the different educational disciplines they afford. The mere twisting of a kaleidoscope containing the fragments of knowledge traditionally taught will not suffice. Attempts to make this do have resulted in highly complex time-tables, which reflect the accidental if occasionally pretty juxtaposition of diverse unrelated elements.

The conception of geography we are now advocating makes it one of the desired subjects which transmutes the diverse and apparently unrelated elements into a naturally constituted complex. It permits a reconciliation between the views of the utilitarian and the educationalist, between the student of physical science and the humanist. Geography, as we have seen, is not physiography plus topography. Its method is not primarily analytic, but synthetic, and hence it did not progress rapidly in times of intense analytical specialism. We are entering on another time, and, as de Lapparent has said, the day of wider syntheses is dawning. The geographical synthesis is one of the most important, involving as it does the space relationships of groups of phenomena on the Earth's surface. Its educational value lies in its being a synthesis which in its simpler elements is obvious to the very young, and in its more complex ones presents problems difficult enough to attract the keenest intellects, while its results have a direct bearing on national as well as on individual life. Instead of being most suitable and important in the junior classes, the reverse is nearer the truth.

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* "Regional Geography," J. A. White, *Geographical Teacher*, vol. ii., February, 1904; "Regional Geography," J. B. Reynolds, *Geographical Teacher*, vol. ii., February, 1904; "Regional Geography in the Schools," J. F. Unstead, *Geographical Teacher*, vol. ii., October, 1904.

† "Field Work in Physical Geography," W. M. Davis, *Journal of Geog.*, vol. i., 1902; "Practical Exercises in Physiography," W. M. Davis, *Journal of Geog.*, vol. ii., 1903; "The Scope and Practical Teaching of Geography in Schools," A. Morgan, *Geographical Teacher*, vol. ii., June, 1903; "Excursions and the Teaching of Geography," J. Lomas, *Geographical Teacher*, February, 1904; "Practical Use of the Globe," T. Alford Smith, *Geographical Teacher*, vol. ii., June, 1904; "The Use of Large-Scale Maps," A. J. Herbertson, *Geographical Teacher*, vol. ii., October, 1904.

No subject but geography, unless it be sociology, gives the comprehensive outlook on *existing* conditions which must be taken into account in all the larger problems of life, and hence it cannot be ignored with impunity, even in the upper classes of a classical school.

Even in some parts of Germany this is not yet recognized, and the latest congress of German geographers found it necessary to protest against the official point of view.* This is, that "geography is but a technical subject valuable only for its practical utility, but otherwise of no educational interest." Dr. Lampe told the congress of a school inspector from Berlin, a privy councillor, who interrupted a head master when discussing in the geography class the climate of India and its effects on harvests and famines, reprimanded him for wandering so far from the subject, and forthwith began to question the class himself on the capes, mountains, and rivers of Asia! We do not wonder, then, that in Prussia descriptive geography is a subject in the lower classes of gymnasia, and scientific geography is banished from such schools altogether. Even an enlightened director such as Dr. Cauer, of Düsseldorf,† who will find many sympathizers among our public schoolmasters, maintains that no special geography teaching is possible in the upper classes of gymnasia save as an appanage of history. He insists that "classical" history is the subject round which the work of a gymnasium must be planned, but he suggests that for Real-gymnasien and Realschulen geography might well be made the central subject.

Admitting that the evolution of human endeavour and thought in the Mediterranean basin in Greek and Roman times is the best subject to emphasize in schools for the "upper classes," and assuming that this inspires the work of our public schools, geography is, perhaps, nowhere more indispensable both to correlate and to correct—to correlate, by presenting as it does the most stable elements which have permanently influenced the successive phases of Mediterranean history, and set the limits as well as presented the opportunities for human endeavour within the Mediterranean area; to correct, by forcing the attention to the existence of other civilizations under other conditions, and so preventing the popular delusion that there has been only one area with a highly developed civilization. As a corrective it is specially necessary in classical education, as it forces the attention on the complexity of modern conditions outside the Mediterranean basin, which renders any direct application of conclusions justified for this area in ancient times inadvisable without some attempt to estimate the disturbing effect of different circumstances, geographical in the first place, historical in the second. The geography taught, however, must be something very different from much that is commonly called by that name, and in classical schools the human aspects would be emphasized, and the subject would not be so precisely limited as in a purely geographical treatise.

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* "Verhandlungen des vierzehnten deutschen Geographentages zu Cöln," am 2, 3 und 4 Juni 1903 (Berlin: Reimer, 1903), pp. 161–192. Discussion, pp. xxiv.–xxxii.

† "Ueber die Stellung des Geographischen Unterrichts am Gymnasium," P. Cauer, *Geographische Zeitschrift*, viii., 1902, p. 465. See also discussion at Cöln meeting of German geographers noted above.

The recognition of this is a matter of national moment; for in addition to its educational value, geography is of immediate practical importance to pupils in the higher classes of public schools, who will direct the higher administration of public and private affairs. The geographical factor is of supreme significance in administrating a colony, in planning a campaign, or in controlling a large business. Surely it is only common sense to see that it is properly studied by those who will have to direct great enterprises. When its educational and practical value are both taken into account, only ignorance or inertia or the influence of vested interests can explain its omission from the higher classes of schools or from the university.

NOTES ON THE ANGLO-LIBERIAN FRONTIER.*

By Lieut. E. W. COX, R.E.

THE Anglo-Liberian Boundary Commission spent the first six months of 1903 in delimiting and beaconing this frontier. Their work started at the source of the river Niger, lat. 9° 5′ N., long. 10° 47′ W., and ended at the mouth of the river Mannah. The boundary itself started from the intersection of the river Uldafu with the 13th meridian west of Paris, and followed this meridian south to its intersection with the left bank of the river Mannah at low water, which then became the boundary to the coast.

Triangulation was adopted from the Niger source to the starting-point of the boundary. A subtense traverse was carried down the meridian to the river Mannah, and a chain and compass traverse from the Mannah river beacon to the coast.

The subtense traverse gave good results, the average discrepancy between the two values of a ray being 1 in 400. The error of the chain and compass traverse was 1 in 55. The course of the river Meli, which was shown inaccurately on existing maps, was traced from lat. 9° 5′ N. to within a mile or two of its junction with the river Moa.

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* Map, p. 504.

The outpost towns of Kamiendo and Kanre Lahun, about which opinions had varied very widely, were found to be 5 and 2 miles in Liberia respectively. But the outpost town of Korumba was placed some 4 miles west of the boundary.

The Kissi tribe, whose raids along the frontier were still a constant source of trouble for about 30 miles north of the river Moa, did not molest the Commission in any way, probably on account of the large escort of fifty-five men of the West African Frontier Force. The positions of some of the Kissi strongholds in Liberia were fixed by intersection.

The town of Kenewa, which was the farthest point that the Government railway survey had reached at that time, was found to be just west of the boundary. Vahan, an ancient rebel stronghold some 8 miles in Liberia, which had been destroyed in 1898, was visited by part of the Commission. The chief, Bagba, was found to be making every effort to rebuild his town, and restore it to its former importance.

The forest which stretches south from Bariwalla had been described as impenetrable, and inhabited only by elephants and rubber. A road was cut through this forest approximately following the meridian, and traces of elephants and rubber were met with. The course of the Morro river, previously unknown, was traced between Goli and the boundary, and that of the river Mannah from the boundary eastward to the Gola town of Jui in Liberia. The Gola town of Gelaun, some 6 miles north of Jui, was also fixed from Bariwalla. The river Mannah at the boundary is called Mano, or Bewa, and it is only near the mouth that it is called Mannah. All doubts as to whether the Mano or Morro river was the larger were settled by a measurement of the volume of each at their junction. The Mano was found to be the larger. Both the Morro and Mano rivers were in flood when the Commission crossed them. At the boundary they were 40 yards and 100 yards wide respectively, and at their junction 100 yards and 120 yards. The course of the river Mano from its junction with the Morro was traced almost continuously to the coast. It was found to be navigable up to a few miles north of the town of Dia (on its right bank), which is 21 miles from the mouth. On leaving the meridian at its intersection with the river Mano, the Commission at first marched in Liberia, following the road from Jui through Gola Gene to the point where this road crosses the river Mano, opposite the large town of Ba, which lies about 1½ mile from the right bank. At this point the Commission crossed the river and followed the road through Dia to the coast. The natives in Liberia along the Jui—Gola Gene road were in a state of unrest owing to the raids of a marauding chief, Barome. No attempt up to that time had been made to suppress him. As a result of the Commission's work, the mouth of the river Mannah was placed 2 miles westward of its previously accepted position. The country along the boundary seemed to be rich and fertile, especially in the Meli and Moa valleys, but of course the natives were growing only enough rice, cotton, etc., for their own use. No signs of minerals were met with. Owing to the shortness of the working season, however, the Commission had no time to make any thorough researches in this direction. A word must be said in praise of the Mendi carriers who accompanied the Commission for the whole of the six months. Their work was always hard, owing to the large amount of clearing that had to be done. At one time they were reduced to very short rations, but they gave no trouble, and were always cheerful.

LOCH NESS.*

I. THE BATHYMETRICAL SURVEY OF LOCH NESS.

By T. N. JOHNSTON, M.B., C.M., F.R.S.E.

LOCH NESS, which is one of the most beautiful lochs in Scotland, is the largest of the series lying in the great glen of Scotland, and forming the greater part of the waterway known as the Caledonian Canal. It trends in a south-west to north-east direction, extending to a length of 22½ miles, with a maximum breadth, at Urquhart bay, of over 1¾ miles, and covering an area of 21½ square miles. The mean breadth is almost one mile. From a bathymetrical point of view, Loch Ness is an important loch. For a long time it has borne the reputation of being very deep, and this the soundings of the Lake Survey substantiate. The members of the Lake Survey visited Loch Ness in April, 1903, and took soundings, temperature observations, and tow-nettings. During the summer Sir John Murray and members of the staff stayed at Fort Augustus, at the south end of the loch, and carried on continuous observations on the temperatures, seiches, biology, etc. These observations have been continued during the winter by Mr. E. R. Watson, B.A., and Mr. James Murray. In June, 1903, a "limnograph" (an instrument for recording "seiches," which are oscillations of the whole mass of water in a lake) was erected at the monastery pier at Fort Augustus, under the care of Mr. E. M. Wedderburn, M.A., and some good records have been obtained. More recently a series of electrical resistance thermometers has been installed under the care of Mr. E. R. Watson.

Previous to 1903 no systematic soundings had been made in Loch Ness, with the exception of those taken early in last century at the time of the making of the Caledonian Canal, when a series of soundings was taken along the centre of the loch, and a maximum depth of 774 feet (129 fath.) obtained. The Lake Survey did not find so great a depth, the maximum obtained being 751 feet (125 fath.), at a spot almost in the centre of the loch 1¼ miles to the south of Urquhart bay. On the old chart supplied by the canal authorities, the soundings in the shallower portions of the loch practically agree with those taken by the Lake Survey, but in the deeper water the depths differ by 5 or 6 fath., and in some cases the differences are greater. Similar differences have occurred in other lochs which have been sounded by means of rope lines. Loch Morar, which lies in the south-west of Inverness-shire, and which in all probability is the deepest loch in the United Kingdom, was stated to have a depth of 1030 feet, but the greatest depth obtained by the Lake Survey during many hours' search over the limited 1000-feet area was 1017 feet.

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* Meeting of Research Department, January 18, 1904.

In Loch Ness the Lake Survey took about 1400 soundings, using the Pullar sounding-machine, and these soundings are all reduced to the datum level of 52·6 feet above sea-level, which was the level of the water surface on the first day that operations were begun.

The loch is fed by numerous burns and several large streams. The rivers Oich and Tarff fall in at the head of the loch at Fort Augustus; on the west side the Moriston, the Coilte and the Enerick enter, and on the east side the Foyers and the Farigaig. The river Ness, issuing from the north end, drains the loch. The drainage area of Loch Ness is very extensive; it extends to 696 square miles, being more than 32 times the area of the loch.

The basin of Loch Ness is of a simple character, and probably at one time the 600 and 700 feet areas were continuous from end to end, but the detrital material brought down by the river Foyers has filled up the bed of the loch to a considerable extent, dividing the areas over 600 and 700 feet deep into two divisions. The bottom of Loch Ness is remarkably level, showing no irregularities, with the above exception, and it is covered with black peaty mud, and in places with a stiff clay of a dull yellow colour. The absence of islands is striking, there being only one small islet, called "Cherry island," near the west shore not far from Fort Augustus. It is said that the level of Loch Ness was raised a few feet when the canal was made, but at one time the water must have stood at a considerable height above its present level, as is shown by the terraces at the mouth of the river Foyers, and by the beaches which can be seen at Dores, at the north end of the loch.

The slopes of the sides of the basin are very steep, especially on the west side to the south of Abriachan, and on the east side, where off the "Horseshoe" a depth of 316 feet was obtained at a distance of 150 feet from shore; on the same side, opposite Invermoriston, soundings of 652 feet were obtained at a distance of 360 feet from shore. The mean depth of Loch Ness is very great, being 436 feet. Loch Morar, which has a maximum depth of 1017 feet—266 feet more than Loch Ness—has a mean depth of 284 feet. The volume of Loch Ness is estimated at 261,000 million cubic feet, which is about three times that of Loch Morar, so that Loch Ness may fairly be regarded as the largest body of fresh water in Great Britain.

II. MOVEMENTS OF THE WATERS OF LOCH NESS, AS INDICATED BY TEMPERATURE OBSERVATIONS.

By E. R. WATSON, B.A., B.Sc.

The view that the waters of the Scottish lochs were at rest, and that the temperature changes were due to the transmission of heat through the stagnant waters, was long ago rendered untenable. In a paper* published in the year 1888, Sir John Murray showed that the distribution of temperature in the waters of Loch Ness was very largely dependent on the force and direction of the winds blowing over the surface of the loch. In connection with the Survey of the Scottish Lochs, which is being carried on under the superintendence of Sir John Murray and Mr. Laurence Pullar, it was considered desirable to undertake a detailed study of the temperature conditions of the waters of Loch Ness.

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* Murray, "On the Effects of Winds on the Distribution of Temperature in the Sea and Fresh-water Lochs of the West of Scotland," *Scott. Geogr. Mag.*, vol. iv. p. 345, 1888.

Accordingly, I, together with Sir John Murray, Mr. E. M. Wedderburn, and other members of the Lake Survey Staff, commenced in July, 1903, a systematic study of the temperatures of the different strata of water in Loch Ness. As a first step, the temperatures were taken at the station near Fort Augustus several times a day for several days. Temperature-depth curves were drawn from these observations and examined. Fig. 1 gives a few of these curves. Had the waters of the loch been at rest, there would have been observed considerable regularity in the temperature changes—a steady seasonal rise of temperature compounded with a slight diurnal fluctuation in the upper strata, and the magnitude of the temperature changes always smaller for the deeper strata than for the upper strata. There was observed no such regularity in the temperature changes, as will be seen by a glance at Fig. 1. On a first examination, it

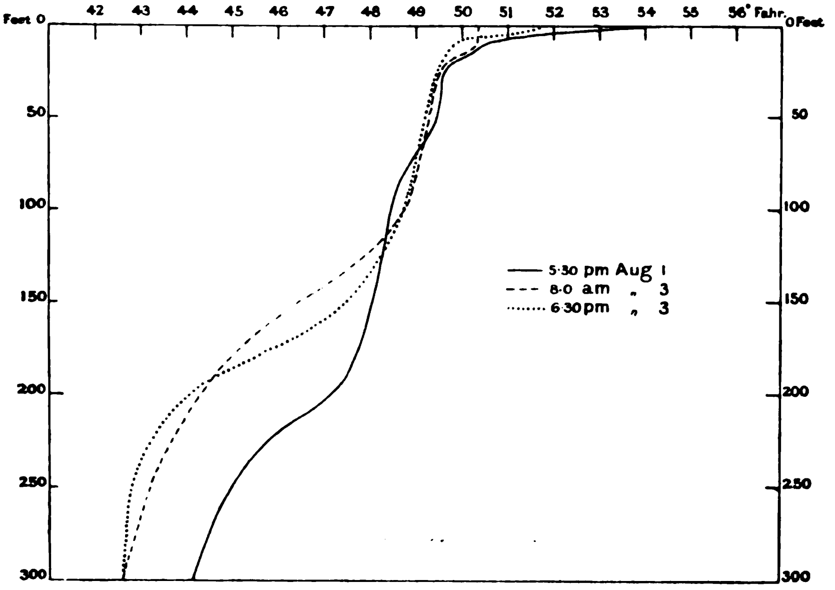


Fig. 1

seemed that the temperature at any depth down to 300 feet was liable to large and sudden changes, by which it was either increased or decreased, and there seemed to be no relation or co-ordination between the temperature changes at different depths. The only conclusion which could be drawn from such observations was that the waters of the lake were continually moving—that there were considerable currents throughout the whole volume of water from the surface right down to 300 feet at least, and that the temperature changes were due to these currents, which were continually replacing the water at any one point by water at some other temperature.

The observations were now extended. Cruises were made along the loch in a steam-launch, and temperature series taken at four or five stations equally spaced along the axis. It was found that these large and irregular temperature changes were not confined to the station near Fort Augustus, but that changes equally large and irregular occurred at all the stations. But, at the same time, the temperatures at any one of the stations differed from those at the other stations.

In order to study the observations made during cruises, a vertical longitudinal section through the loch basin was made, and vertical lines drawn at the observation stations. The temperature observations made were recorded at the proper distances below the surface along these lines, and isothermal lines were drawn connecting the points having a common temperature. For convenience, the isotherms 53°, 51°, 49°, 47° Fahr., etc., were drawn. Such a section is shown in Fig. 2.

It may here be mentioned that Loch Ness is a long, narrow, straight basin, and that consequently it is possible, by means of this one vertical longitudinal section, to give an almost perfect representation of the distribution of heat throughout the loch.

By an examination of a series of such diagrams, it was found that—

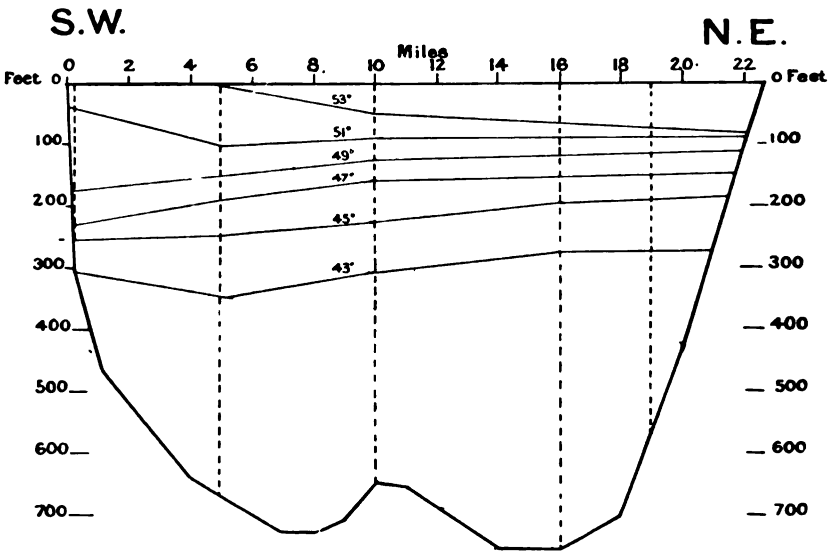


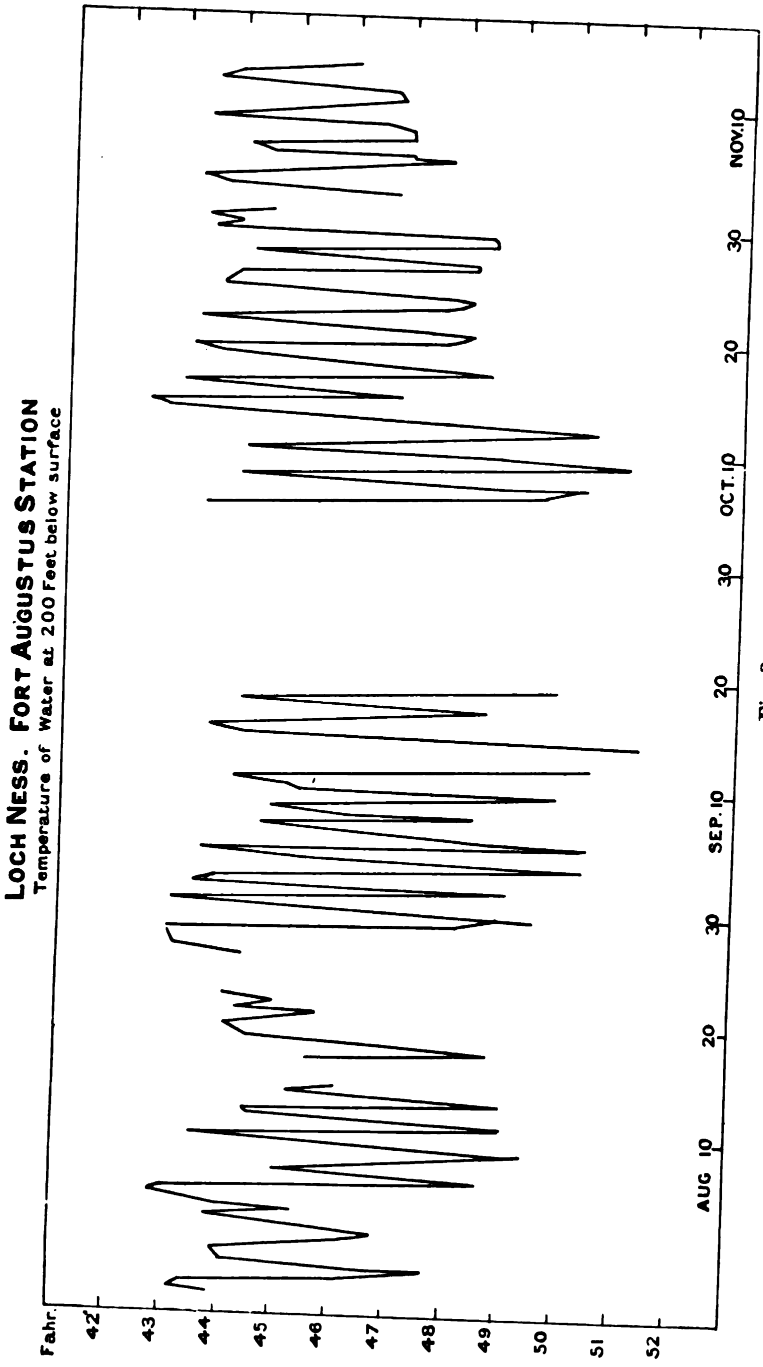
Fig. 2

(1) *The isotherms are never horizontal, but are inclined at all possible angles, some being, as a rule, sloping in the opposite direction from others.*

(2) *The isotherms are continually and quickly altering their inclinations* : the changes are so great and rapid that the diagram drawn as the result of one day's cruise would be found entirely different from that given by the preceding day's cruise.

(3) The area between two consecutive isotherms remained practically constant from one day to the next, although of course the shape of this area had entirely altered.

This last result was of the greatest use for a study of the currents: it meant that the bulk of water at any particular temperature remained practically constant, although this water was being continually moved to and fro by currents, and that if it had been possible to replace the isothermal surfaces by watertight but perfectly flexible membranes, then these membranes would not have affected the changes occurring in the loch. But it is obvious that by watching the movements of such membranes we could have gained a great insight into the current system of



LOCH NESS. FORT AUGUSTUS STATION

Temperature of Water at 200 Feet below surface

Fig. 3

the loch—hence the utility of a study of the motion of the isotherms, for they are nothing but these hypothetical watertight partitions made visible by temperature observations.

An attempt was now made to study the cause and method of these movements of the isotherms—in other words, the current-system of the loch was examined.

It has long been held by oceanographers that a wind blowing along the surface of the ocean will produce a surface-current in the same direction as itself, and such a surface-current will necessarily produce consequent-currents. Sir John Murray has shown the existence of similar currents in several Scottish lochs.

By the use of these suggestions it was found possible to make a short statement describing briefly, but accurately, the cause and mode of movement of the upper isotherms. A wind blowing along the surface of the loch blows with it the hot surface-water, which is thus gathered to the lee end of the basin, whilst colder water comes to the surface at the windward end to take its place. In terms of isotherms, a wind blowing along the surface of the loch produces, or tends to produce, a slope of the upper isotherms down towards the lee end of the loch. I say "tends to produce," because the observations on Loch Ness show that a south-west wind produces this effect much more easily than a north-east wind. There seems to be a predisposition on the part of the upper isotherms to slope down towards the north-east end of the loch. This may be due to the head-to-foot flow of the loch, which is from south-west to north-east.

But whilst the movements of the upper isotherms are thus easily summarized, those of the lower isotherms remained for a considerable time a complete mystery. It was natural to suppose that the deeper the isotherm the less would it be influenced by the winds, and that perhaps a strong wind would produce a slight tilt in the deeper isotherms in the same direction as the tilt in the upper isotherms, but that, as a rule, the deeper waters would remain uninfluenced and at rest, and that the deeper isotherms would be horizontal surfaces. This, however, was found to be by no means the state of affairs. It was found that—

(*a*) Very often the lower isotherms had a tilt in the opposite direction from the upper isotherms;

(*b*) There was no more approach to horizontality in the lower isotherms than in the upper;

(*c*) Even after a protracted calm the isotherms were still not horizontal, and still in motion.

To study these movements of the lower isotherms, I made use of the systematic temperature observations which have been taken several times a day at the Fort Augustus station, begun July, 1903, and continued right on till the waters had become of almost uniform temperature throughout. I drew curves giving the change with time of the temperature at different depths. Fig. 3 gives the change with time of the temperature at 200 feet below the surface.

The table on page 435 gives the observations from which Fig. 3 was constructed.

It will be seen that the temperature at this depth at the Fort Augustus station changed in a regular periodic fashion, the length of a period being about three days, and the difference of temperature between a maximum and a minimum being about 5° Fahr. By drawing similar curves for other depths, I found that at greater depths the temperature exhibited the same periodic change, the length of the period being the same and the phase the same, whilst the amplitude got less and less the greater the depth of the point considered. Similarly, at less depths than 200 feet the change had the same periodicity and the same phase, and again smaller amplitude than at 200 feet, but here the regular nature of the change was somewhat obscured, apparently by other changes occurring at the same time—those changes due to the wind which we have already mentioned.

LOCH NESS, FORT AUGUSTUS STATION. TEMPERATURE OF WATER AT 200 FEET BELOW SURFACE.

Time.	Temp. (corr.) Fahr.	Time.	Temp. (corr.) Fahr.	Time.	Temp. (Corr.) Fahr.
	°		°		°
July 27, 7.45 a.m.	43·9	Sept. 1, 8.0 a.m.	49·1	Oct. 20, 4.30 p.m.	48·2
„ 27, 5.0 p.m.	43 2	„ 1, 7.0 p.m.	43·4	„ 21, 10.30 a m.	47·1
„ 28, 8·0 a.m.	43·4	„ 2, 8.0 a.m.	43·8	„ 22, 10.0 a.m.	43·3
„ 28, 9.0 p.m.	46·3	„ 3, 8.0 a.m.	59·3	„ 22, 4.0 p.m.	43·3
„ 29, 8.0 a.m.	47·8	„ 3, 6.0 p.m.	47·4	„ 23, 10.0 a.m.	47·8
„ 29, 12.0 noon	46·7	„ 4, 8.0 a.m.	45·1	„ 23, 6.0 p.m.	48·2
„ 30, 12.0 noon	44·1	„ 4, 7.0 p.m.	43·5	„ 24, 10.30 a.m.	47·5
„ 31, 8.0 a.m.	43·9	„ 5, 8.0 a.m.	50·4	„ 24, 4.30 p.m.	47·4
„ 31, 9.0 p.m.	45·1	„ 5, 6.0 p.m.	48·0	„ 25, 10.30 a.m.	43·7
Aug. 1, 8.0 a.m.	46·4	„ 7, 8.0 a.m.	44·6	„ 26, 10.0 a.m.	44·0
„ 1, 6.0 p.m.	46·8	„ 7, 5.0 p.m.	48·4	„ 26, 4.0 p.m.	48·2
„ 3, 8.0 a.m.	43·8	„ 8, 8.0 a.m.	46·2	„ 27, 10.0 a.m.	48·2
„ 3, 7.0 p.m.	45 3	„ 8, 6.0 p.m.	44·7	„ 27, 8.0 p.m.	46·0
„ 4, 9.30 a.m.	44·0	„ 9, 8.0 a.m	46·6	„ 28, 8.0 a.m.	44·6
„ 5, 8.0 a.m.	42·8	„ 9, 7.0 p.m.	49·9	„ 28, 10.0 a.m.	44·2
„ 5, 9.0 p.m.	43·0	„ 10, 8.0 a.m.	45·3	„ 28, 8.0 p.m.	48·5
„ 6, 8.0 a.m.	48·6	„ 10, 7.0 p m.	45·0	„ 29, 8.0 a.m.	48·4
„ 6, 6.0 p.m.	46·7	„ 11, 8.0 a.m.	44·1	„ 29, 8.0 p.m.	48·6
„ 7, 7.0 a.m.	45 0	„ 12, 8.0 a.m	50·4	„ 30, 8.0 a.m.	43·5
„ 8, 12.0 noon	48·0	„ 14, 8.0 a.m.	51·4	„ 30, 8.0 p.m.	44·1
„ 8, 9.0 p.m.	49·4	„ 15, 8.0 a.m.	44·2	„ 31, 8.0 a.m.	43·4
„ 10, 12.30 p.m.	43·5	„ 15, 6.0 p.m.	43 6	„ 31, 4.0 p.m.	44·6
„ 11, 8.0 a.m.	49·0	„ 16, 8.0 a.m.	45·0	Nov. 2, 10.30 a.m.	46·8
„ 12, 8.0 a.m.	44·5	„ 17, 8.0 a.m.	48·6	„ 2, 5.0 p.m.	46·0
„ 13, 8.0 a.m.	49·1	„ 18, 8.0 a.m.	44·2	„ 3, 10.0 a.m.	43·7
„ 13, 12.0 noon	47·3	„ 19, 8.0 a.m.	49·8	„ 3, 5.0 p.m.	43·3
„ 14, 8.0 a.m.	45·2	Oct. 5, 5.0 p.m.	43·5	„ 4, 10.0 a.m.	45·7
„ 14, 8.0 p.m.	46·0	„ 6, 9.0 a.m.	47·5	„ 4, 5.0 p.m.	46·0
„ 17, 10.0 a.m.	45·5	„ 6, 5.0 p.m.	49·5	„ 5, 10.30 a.m.	47·7
„ 17, 7.0 p.m.	48·7	„ 7, 9.0 a.m.	50·2	„ 5, 3.0 p.m.	47·1
„ 18, 10.0 a.m.	47·6	„ 7, 4.0 p.m.	48·4	„ 5, 9.0 p.m.	47·1
„ 18, 8.0 p.m.	46·8	„ 8, 9.0 a.m.	44·1	„ 6, 9.30 a.m.	44·5
„ 19, 9.0 a.m.	44·5	„ 9, 9.0 a.m.	51·0	„ 6, 9.30 p.m.	44·1
„ 19, 7.0 p.m.	44·2	„ 10, 10.30 a.m.	48·4	„ 7, 10.0 a.m.	47·0
„ 20, 8.0 a.m.	44·0	„ 10, 1.0 p.m.	44·2	„ 8, 10.30 a.m.	47·0
„ 20, 4.0 p.m.	44·1	„ 12, 9.0 a.m.	50·1	„ 8, 6.0 p.m.	46·5
„ 21, 8.0 a.m.	45·7	„ 12, 2.30 p.m.	50·4	„ 9, 10.0 a.m.	45·0
„ 21, 6.0 p.m.	44·2	„ 13, 9.0 a.m.	46·6	„ 9, 9.0 p.m.	43·4
„ 22, 8.0 a.m.	44·9	„ 13, 4.30 p.m.	44·4	„ 10, 10.0 a.m.	46·3
„ 22, 7.0 p.m.	43·9	„ 14, 9.0 a.m.	42·7	„ 10, 9.0 p m.	46·3
„ 26, 8.0 a.m.	44·2	„ 14, 4.30 p m.	42·3	„ 11, 9.30 a.m.	46·8
„ 26, 6.0 p.m.	43·3	„ 15, 10.0 a.m.	46·9	„ 11, 9.0 p.m.	46·7
„ 27, 8.0 a.m.	43·1	„ 15, 3.30 p m.	46·5	„ 12, 1.0 p.m.	45·3
„ 28, 8.0 a.m.	43 0	„ 16, 5.0 p.m.	43·0	„ 12, 10.0 p.m.	43·4
„ 28, 6.0 p.m.	43·0	„ 17, 8.30 a.m.	48·5	„ 13, 3.0 p.m.	43·8
„ 29, 8.0 a.m.	48 0	„ 19, 10.0 a.m.	43·5	„ 13, 9.0 p.m.	46·0
„ 29, 6.0 p.m.	49·2	„ 19, 4.0 p.m.	43·2		
„ 31, 8.0 a.m.	43·0	„ 20, 10.0 a.m.	47·7		

In terms of isotherms, these observations revealed a pendulous swinging of the ends of the isotherms, the amplitude of the swing being greatest for the isotherm in the region 200 feet below the surface, and dying off both above and below this region. A few other observations taken simultaneously with these at other parts of the loch show that the isotherms are swinging as a whole about a transverse central axis.

To what can this swinging be due?

If we take a long rectangular trough with glass sides, and put into it a layer of water, and above the water a layer of lighter oil, and then disturb the arrangement, one of the movements observed will be a swinging of the interface between the oil and water. The longer the trough the slower will be the period of this movement; a large difference of density between the upper and lower liquids will give a quick period, and a small difference of density a slow period. The time of swing can be calculated from the formula—

$$t = \frac{2l}{\sqrt{\dfrac{g(\rho - \rho')}{\dfrac{\rho}{h} + \dfrac{\rho'}{h'}}}}$$

where t = time of swing,
l = length of trough,
ρ' = density of upper layer,
ρ = density of lower layer,
h' = depth of upper layer,
h = depth of lower layer,
g = acceleration due to gravity.

Now, in the loch we have warmer, and therefore lighter, water lying above colder and heavier water, and, roughly speaking, the greatest temperature change occurs about 200 feet below the surface. So it seems to me that, after a suitable displacement, the waters may swing with a movement similar to that observed in the trough, the warmer upper waters taking the place of the oil, and the isotherm in the region of most abrupt temperature change, *i.e.* at about 200 feet, taking the place of the interface between the oil and water. Such a swinging would produce the observed periodicity in the temperatures, would account for the observed fact that sometimes the lower isotherms are tilted in a direction opposite from that of the upper isotherms, and for the fact that even after a protracted calm the isotherms are still in motion. To calculate exactly the period of such a swinging would be a very difficult matter, but we can obtain an approximate value by assuming that the waters above 200 feet are of a uniform temperature equal to the mean, and similarly for the waters below 200 feet.

Thus in August we should have—

ρ' = density of water at 50°·5 Fahr. = 0·999704
ρ = density of water at 43° Fahr. = 0·999965

also we have—

h' = 200 feet
h = 400 feet
l = 131,000 feet

From which we calculate—

t = 68 hours

which is of the same order as the period observed.

Since winds produce a tilt in the isotherms, and the stronger the wind the greater the depth to which its effect is felt, it seems probable that these swingings are started by strong winds which are able to displace the isotherms in the critical

It is very important that the observations which have been begun in Loch Ness should be continued and amplified, in order that we may learn more about this extraordinary phenomenon. Up to the present we have only routine observations at one station, taken at intervals of several hours.

During the next season it will be possible to use the electrical thermometers which have now been satisfactorily installed at Fort Augustus, and thus to obtain a continuous record of the temperature change at a suitable depth at the Fort Augustus station. Besides this record, it is very important that we should have simultaneous observations at other stations, say at the centre of the loch and at the north-east end, in order that the movements of the isotherms throughout their whole length may be studied. These observations should extend over a considerable period.

It seems probable that similar movements will exist in other lochs, and it would be exceedingly interesting to determine the periods of such movements in basins of different dimensions, but for the present it would be preferable to study the phenomenon more thoroughly in Loch Ness. I may mention, however, that Prof. Forel believes that certain observations which he has made in Lake Geneva may perhaps be explained by the existence of similar movements in this lake, and that he intends during the forthcoming season to look further into the matter.

III. ON THE IONIZATION OF AIR IN VESSELS IMMERSED IN DEEP WATER.

By E. R. WATSON, B.A., B.Sc.

During the year 1903 and the early part of 1904, in connection with the Bathymetrical Survey of the Fresh-water Lochs of Scotland, I was able to make a few experiments on the electrical conductivity of air enclosed in vessels immersed in the waters of Loch Ness.

Briefly, the experiments may be described as follows:—

Within a cylindrical copper vessel was a small brass cylinder carried by a non-conducting support. This insulated cylinder could be given an electrical charge, and the rate at which this charge leaked away could be examined by reading from time to time the deflection of a gold-leaf attached to the charged cylinder. Since the supports were non-conducting, the leak of the electrical charge was through the air contained in the vessel, and in this way the electrical conductivity of the air in the vessel was examined. The object of the experiments was to compare the rate of leak when the vessel was immersed to various depths in the water of the loch with the rate of leak when the vessel was standing in air. This work was suggested to me by Mr. C. T. R. Wilson, Fellow of Sidney-Sussex College, Cambridge, and is seen to be of great interest when one considers the theories brought forward to explain the leak of electrically-charged bodies surrounded by air. This leak is supposed to be due to the continuous production in the air of a small number of ions, or electrically-charged particles of molecular dimensions. Now, such ions are produced in quantity on the passage of various rays through air, and it is generally supposed that the ionization of ordinary air is due to the passage through it of a radiation of some kind. If this be the case, then it will probably be possible, by surrounding a vessel with suitable matter, to shield it from the radiation, and thus prevent the ionization of the air within it and destroy its electrical conductivity. Mr. Wilson (*Proc. Roy. Soc.*, vol. 68, pp. 159–161) was unable to detect any diminution in the ionisation of the air in a vessel when it was taken into a tunnel and thus screened by the rocky walls of the tunnel. McLennan and Burton ('Univ. of Toronto Studies,' Phys. Sci. Series, 1903), on the other hand, record a 37 per cent. diminution in the conductivity of air in a vessel by merely surrounding it with a layer of water 25 cms. thick. It therefore seemed of interest to repeat the experiments under conditions which would allow of the vessel being surrounded on all sides by at least 120 feet of water.

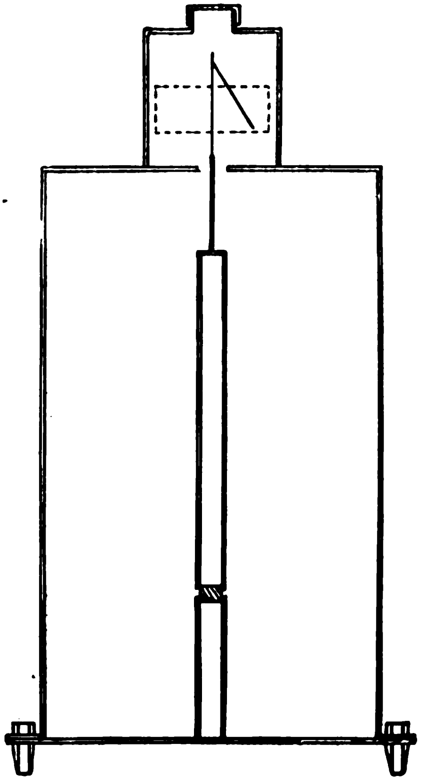


FIG. 4.

Apparatus.—The vessel is shown in section in Fig. 4. It is a copper cylinder of 12 cms. diameter and 20 cms. high, with walls 1 mm. thick. The contained conductor is a brass rod 12 cms. long and 1 cm. diameter, coaxial with the vessel. This is carried by a similar brass rod, 5 cms. in length, rising from the bottom of the vessel, and the two are connected by a short length of quartz rod. The insulated conductor has at its upper end a slight brass rod carrying a gold-leaf. This brass rod projects through a hole 1 cm. in diameter in the top of the cylindrical vessel, and is surrounded by a small copper cube, sides 5 cms. long, containing windows through which the gold-leaf can be read by means of a telescope. At the top of the cube there is a small brass cap, which can be removed to charge the conductor.

The air within the vessel is kept moderately dry by means of calcium chloride carried in a gauze-covered tray fastened to the bottom of the vessel.

This vessel can be rigidly fixed within a cast-iron shell with walls 0·5 cm. thick. This outer shell can be closed watertight and lowered by means of a line to any required depth in the water.

Preliminary Observations.—By observing the rate of leak when the vessel was standing in air, the following facts were learnt:—

(1) The deflection of the gold-leaf, over a considerable range, was proportional to the potential of the charge on the conductor. This made it possible to express the rate of leak completely by saying that in unit time the displacement of the gold-leaf decreased by so many divisions.

(2) The rate of leak varied somewhat from day to day. There was an apparently irregular variation of 5–10 per cent.

(3) The rate of leak was not altered by surrounding the vessel with the cast-iron shell.

By enclosing the vessel in a bell-jar and reducing the air-pressure, it was found that for moderately low pressures the rate of leak was proportional to the air-pressure. The following table gives the experimental results:—

Pressure (cms. of mercury).	Rate of leak.
18·6	0·67
11·4	0·42
5·15	0·21
2·85	0·11

By plotting a curve (Fig. 5), giving the pressure and the rate of leak as respective co-ordinates, it is seen that the rate of leak is proportional to the pressure, so that in a vacuum there would be no leak at all. This shows that the leak is entirely due to the conductivity of the air in the vessel, and that the insulating power of the quartz-rod support is perfect.

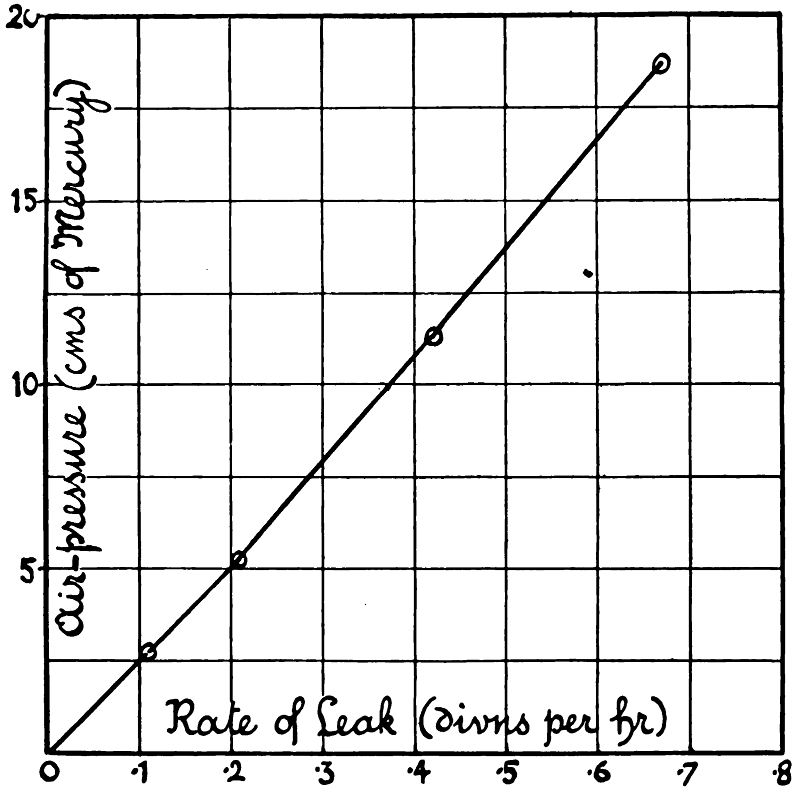


FIG. 5.

Comparison of the Values of the Rate of Leak when the Vessel is immersed, and when it is standing in Air.

In August, 1903, it was not practicable to allow the vessel to remain immersed more than three to four hours, and on calculating the rate of leak from the change of deflection in this time it was impossible to detect any certain change in the rate of leak produced by the immersion of the vessel. Observations were made at 10 feet, 50 feet, 150 feet, and 230 feet, the vessel touching the bottom of the loch in the last instance.

Later in the year it was practicable to allow longer immersions.

The table on page 441 gives the results of several experiments in which the vessel was immersed for about twelve hours. Between successive immersions a control determination of the rate of leak in air was made. The vessel was always let down at the same spot in the loch, a point about a quarter of a mile from shore, at the south-west end of the loch. The bottom was about 250 feet below the surface. At the time of the observations the temperature of the water was almost uniform from top to bottom, and about 43° Fahr.

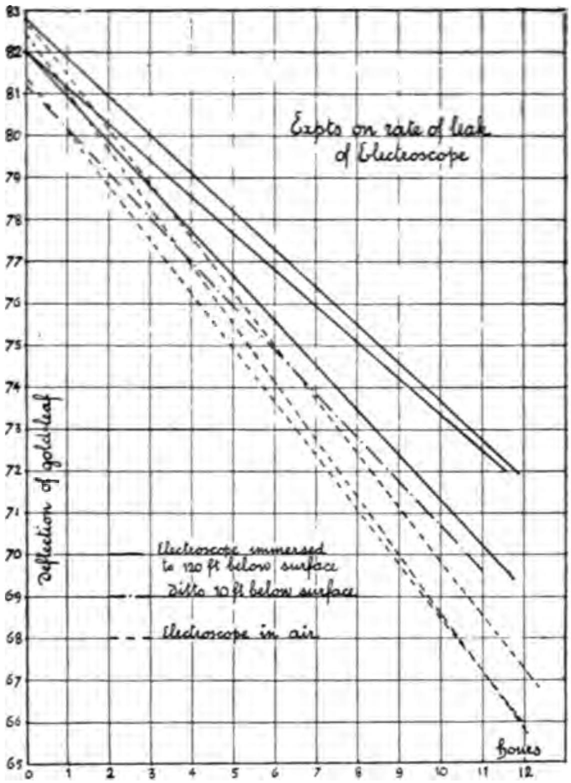


FIG. 6.

These results are also shown diagrammatically in Fig. 6.

The conclusion which can be drawn from these observations is that by surrounding the vessel with a layer of water 120 feet thick, the conductivity of the air within the vessel is not reduced to less than 75 per cent. of the value which it has when the vessel is standing in air.

Expt. No.	Position of electroscope.	Time.	Deflection of gold-leaf.	Rate of leak (divisions per hour).
I.	120 feet below surface	10 a.m., Dec. 31, 1903 9.50 p.m., Dec. 31, 1903	82·8 71·9	0·92
III.	Ditto	10.15 a.m., Jan. 1, 1904 9.55 p.m., Jan. 1, 1904	82·0 69·4	1·08
V.	Ditto	10 a.m., Jan. 2, 1904 9.25 p.m., Jan. 2, 1904	82·2 72·1	0·86
VII.	10 feet below surface	10.15 a.m., Jan. 4, 1904 9.15 p.m., Jan. 4, 1904	81·3 69·5	1·07
II.	In air	10 p.m., Dec. 31, 1903 10.12 a.m., Jan. 1, 1904	82·5 65·7	1·37
IV.	In air	9.55 p.m., Jan. 1, 1904 9·50 a.m., Jan. 2, 1904	81·5 66·0	1·30
VI.	In air	10.5 p.m., Jan. 2, 1904 10.30 a.m., Jan. 3, 1904	82·8 66·8	1·28

IV. SEICHES OBSERVED IN LOCH NESS.

By E. MACLAGAN-WEDDERBURN, M.A.

The first observations on seiches in Scotland were made in 1902 by members of the Lake Survey, the differences in level having been measured by a foot-rule. A Sarasin limnograph was procured by the Survey, and was set up at Fort Augustus on Loch Ness in June, 1903, and has been recording since then, with only a few stoppages. The biggest seiche so far recorded had an amplitude of about 11 cms. The boat-house of St. Benedict's Abbey, kindly put at Sir John Murray's disposal by the Lord Abbot, gave shelter to the instrument both from wind and waves.

Three types of seiches are common on Loch Ness, with periods of approximately 31·5, 15·3, and 8·8 minutes. The first of these is probably the uninodal seiche. It seldom occurs pure, or of any considerable magnitude. This may be due to the influence of Loch Dochfour, which is a continuation of Loch Ness at the north-east end. The two lochs are connected by a narrow channel about 20 feet deep, through which a strong current sometimes flows, and for this reason, in calculating the theoretical period of the seiche, it was thought proper to omit Loch Dochfour.

The period was calculated in two ways. First, by the formula $t = 2\int dl \sqrt{\frac{b}{ag}}$, where b is the breadth and a the area of a cross-section at any particular point. This is the formula obtained by assuming the hypothesis of parallel sections. The value obtained was 42 minutes, which is considerably in excess of the observed value. The period was then calculated by the formula $t = 2\int \frac{dl}{\sqrt{gh}}$, and the value obtained for t was 30·9 minutes, which agrees very closely with the observed value. This method assumes that the period of the seiche would be the same if the shores of the loch rose perpendicularly instead of obliquely.

The binodal seiche, whose period is about 15·3 minutes, is usually very well marked. It is the commonest type, and lasts longer than the uninodal seiche. The node is probably somewhere in the neighbourhood of Inverfarigaig, but has not yet been accurately determined. It is also interesting because its period is less than half the period of the uninodal seiche, although, according to Du Boys, it ought always to be greater than half; and in most lochs it is so, the most notable exception being Lake Geneva. The basin of Loch Ness is so regular that it is difficult to explain it, as was attempted in the case of Lake Geneva, by assuming an oscillation of part of the loch.

The polynodal seiche, whose period is 8·8 minutes, is always of small amplitude, but sometimes very regular. There are also oscillations of shorter period, but they do not occur regularly enough to allow of their measurement with any degree of accuracy. On one or two occasions there were embroideries on the curve, which may have been due to transverse seiches. Owing to the narrowness of the loch, the period of such a seiche would only be about one minute. These embroideries may be due to a variety of causes, such as the wash of steamers, the opening of the lock-gates in the canal, etc. It will only be possible to determine whether they are vibrations or transverse seiches by simultaneous observations at the two sides of the loch.

The range of atmospheric conditions at Fort Augustus included thunderstorms, and earthquakes also occurred, but these had no very marked influence on the loch. It seems probable that the cause of seiches is sudden local variations of atmospheric pressure; and this view is supported by the records of a barograph at Fort Augustus. The polynodal seiches, and perhaps the uninodal and binodal seiches also, may be started by sudden gusts of wind. The wind blows down the various glens in strong, almost vertical gusts, and this may be sufficient to start the oscillation.

All the speculations, however, regarding the causes of seiches can only be satisfactorily tested by quantitative measurements of the forces at work, and it is hoped that something will be done in this direction in the summer of 1904.

V. BIOLOGY OF LOCH NESS.

By JAMES MURRAY.

The observations made by the members of the Lake Survey during the summer and autumn of 1903 showed that, while every part of the loch, down to the deepest part of the bottom, has its inhabitants, there is one area in which life, if not altogether absent, is very rare. This area is the open water of the loch from a depth of 300 feet to the bottom. Fish may live in this region, but none of the animals obtainable by our nets have been collected in it.

In studying the distribution of organisms in the loch, it is convenient to follow Forel in dividing it into three regions—the Pelagic, the Littoral, and the Abyssal. Each of those regions possesses a distinct association of species.

In the open water of the loch there is a small number of animals and plants, distributed with considerable uniformity throughout. Owing probably to the small annual range of temperature occurring in such a large lake, this pelagic association changes very little throughout the year, the only change observed being the disappearance of a few species in winter. The vertical distribution of the species is very unequal, some having a greater vertical range than others. Life is usually densest at some little distance from the surface (say 20 to 50 feet), but at night there is a distinct migration of many species towards the surface.

The shores of the loch support an abundant flora and fauna. The flowering plants, mosses, and algæ, which grow attached to the rocks or stones of the shore, shelter an immense number of microscopic animals. A great many of the species characteristic of this region extend to a very considerable depth, beyond the limits at which plants cease. The majority of the Entomostraca and many species of Rotifera and other microscopic animals have been dredged at a depth of nearly 300 feet. It is supposed that the abundant deposit of vegetable *débris* on the bottom of the loch takes the place of growing plants in maintaining this rich fauna.

The abyssal fauna includes a few species which are generally distributed all over the bottom from a depth of 300 feet to the deepest parts of the loch. Below 300 feet the majority of the littoral species cease. A few, such as *Hydra rubra*, some water-mites, and a *Limnæa*, found at depths of from 400 to 600 feet, were so rare that they may be regarded as casually present.

The abyssal fauna includes species representing most of the great groups of aquatic animals. There are Insects, Molluscs, Entomostraca, Worms (Oligochœtes, Turbellarians, Nematodes, and one Rotifer), and Infusoria. These species are not confined to the deeper parts of the loch. The majority of the species range right up to the shore. So far as we have gone, we have found no peculiar species in the abyssal fauna. It seems to be merely an extension of the littoral fauna, including those species which are best able to adapt themselves to the peculiar conditions of the abyssal region. When brought to the surface, the abyssal animals appear to suffer no inconvenience, and thrive well in bottles. A more critical examination of the species by experts may modify our conclusion as to the origin of the abyssal fauna. In one group only, the Rotifera, have we found what may be incipient species, the eyes being often reduced in size or altogether absent.

After the reading of the above papers, Sir John Murray, Lord Belhaven, Prof. Garwood, Dr. H. R. Mill, Mr. Ravenstein, Mr. Chisholm, Mr. Freshfield, and the Chairman took part in a long and interesting discussion on the various problems raised by the communications, and the hope was expressed that these observations and investigations would be continued and extended.

Sir John Murray stated that arrangements were in progress to make a much more detailed investigation of the temperatures and seiches in Loch Ness during the coming summer. All the principal Scottish lochs had now been surveyed, but during next year the survey of the smaller ones would be undertaken, and, so far as possible, completed.

ON MOUNTAINS AND MANKIND.*

By DOUGLAS W. FRESHFIELD.

A GEOGRAPHER or traveller who has been called upon to preside over the meetings of our Section of the British Association may be excused for feeling some hesitation as to the character he shall give to the address which custom compels him to deliver. He cannot but be aware that his audience, while it includes not a few experts, probably far better qualified than himself to take the chair, is composed mainly of those whose concern in geography can only be a general and occasional one.

To compose a summary of the geographical events of the year would be a simple and obvious expedient, were I not conscious that in this I have been forestalled by the indefatigable President of the Royal Geographical Society. Again, to consider the progress of geography during, say, the last quarter of a century, might be instructive to "the general." On the other hand, on his special subject, your President may possibly be able to add something to the common stock by way of observation or suggestion.

Bearing in mind the, from the point of view of posterity, almost excessive energy with which the nineteenth century carried on the exploration of the globe, narrowing in every direction the field left to our explorations and our imaginations, 1904 may so far be counted as an *annus mirabilis* in the annals of geography. We have seen the successful return, if not as yet to our own shores, to safe seas, of the most important expedition ever sent South-Polewards. In the success obtained by Captain Scott and his comrades, we have welcomed a full justification of the course taken in putting the supreme command and direction of the undertaking in the hands of an officer of his Majesty's Navy. "England expects every man to do his duty," and I will not indulge in hyperbolical praise, which might be distasteful to men who have shown in trying circumstances the daring, the cheerfulness, and the resourcefulness which we are accustomed to associate with the British Navy. We have every reason to expect that the results obtained by the energetic and capable men of science attached to the expedition will be of wide bearing and interest, but to attempt to estimate them to-day would be obviously premature.

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* Presidential Address to the Geographical Section at the Cambridge Meeting of the British Association, August, 1904.

The current year has been distinguished by a, perhaps, even more remarkable geographical event. His Majesty's Government, not satisfied with the laurels it has won in the Antarctic, has embarked on a second geographical adventure on a larger scale, and at a far greater cost (which, however, will presumably be borne by India). It has sent forth a Gold Medallist of the Royal Geographical Society, Colonel Younghusband, with a numerous escort to reach the forbidden capital of Tibet. The saffron-vested monks on the "golden terraces" of the Pota La have seen the glimmer of British bayonets on the horizon, and the castle-palaces of Lhasa will, we hope, open to the military explorer their mysterious halls, hitherto known to us best by the descriptions of that entertaining traveller, my friend Chandra Das.

But the fruits of these great expeditions are not yet ripe. I must leave them to be plucked by my successors. I do so with regret, for in some respects polar exploration is closely akin to mountaineering, and I should have listened with a peculiar interest to an account of the fascinating land, over whose peaks and pastures I lately gazed from the heights of the Jonsong La.

To review the progress of geography during the last twenty-five years, the time that has passed since I first joined the Council of the Royal Geographical Society, is tempting. The retrospect would on the whole be encouraging. The last quarter of a century, if not an era of the most extensive discoveries, has been an era of profitable occupation—I mean profitable in the scientific and not in the commercial sense, though the two are frequently connected—of the ground seized by the great pioneers in Africa, in the backlands of North America, and elsewhere. And when we come to consider the manner in which the results of modern exploration are recorded, what an advance we find! Compare the geographical publications of Great Britain in 1880 and 1904; take the most conspicuous instance, those of the Royal Geographical Society at the two periods. *Petermanns Mitteilungen* was for long the one first-rate geographical magazine in Europe. We have now, as we ought to have had long before, a Journal that rivals it. Consider the way in which our literature and lectures are illustrated by the aid of photography, new processes, and the lantern.

Take a wider survey. Look at maps, beginning with the Ordnance Survey. Compare the last issues of the 1-inch maps, with all the advantages of colour-printing, over their doubtless (except as to roads) accurate, but far less intelligible predecessors. Consider the maps private firms, Messrs. Bartholomew and Messrs. Stanford, have provided us with; note those in the new editions of 'Murray's Guides.'

The correction and completion of maps by new explorations is always desirable.

But it is even more important that a sound system for the delineation of natural features should be adopted both in Government surveys and general maps. I begin to look forward to the day when glaciers will no longer be represented, as they were on the early Indian and Caucasian surveys, without their heads or tails—that is, without either their *névés* or their moraine-cloaked lower portions, or with rivers rising above them and flowing through them. In time, perhaps, every closet cartographer will recognize that glaciers do not lie along the tops of lofty ridges, but descend into valleys. In these matters I have had many an arduous struggle with draftsmen of the highest technical skill, but inadequate out-of-door experience. It is cruel that a poor man should be set to delineate snow mountains who has never seen one, and when "a week at lovely Lucerne" can be had for five guineas, it is inexcusable.

In my schooldays there was an exercise of memory known to us by the contemptuous appellation of "Jog," which boys and teachers united to depreciate and despise. This sentiment is now confined to a few elderly generals and head-masters. Geography flourishes as a branch of science under the august shadow of the elder universities. At Oxford we have produced Prof. Ramsay, Mr. Mackinder, Dr. Herbertson, Mr. Grundy, Mr. Hogarth, Mr. Beazley. We have started a school of geography and a school of geographers. At Cambridge, where Mr. Yule Oldham has worked energetically for the promotion of geography to its proper place in the examinations of the university, a Board of Geographical Studies has been established. I may quote what Sir C. Markham said three months ago—

"The staff of the new geographical school at Cambridge will consist, instead of one reader, of several lecturers and teachers, who will cover the various departments of the science. A diploma in geography will be granted as at Oxford. But Cambridge goes a step further than Oxford, by introducing geography into the examination for the B.A. degree. The importance of according geography such a position in the studies of the universities must be evident to all, and must be specially gratifying to those who, for over thirty years, have fought hard, amid much discouragement, to have geography recognized as a university subject. It will be interesting to see how the Board of Geographical Studies at Cambridge will draw up the detailed regulations for the degree and the diploma, what steps will be taken to secure a competent staff to cover the whole field of our science, and especially to train young university men for practical work in the field. We have every reason to expect that the results will prove satisfactory.

"The Geographical Association of Teachers, of which Mr. Mackinder and Dr. Herbertson are active members, is doing much to enlighten teachers with regard to the capabilities of the subject, to raise its standard, and to introduce improved methods of teaching. An interesting and useful conference was held last winter at the Chelsea Polytechnic under its auspices, and in connection with the conference there was an excellent exhibition of appliances used in teaching geography, the usefulness of which was increased by sending it to various provincial centres."

In primary schools many teachers are furnishing excellent instruction, and are instructing themselves with the help of the many handbooks provided by Dr. Mill, Mr. Chisholm, and others. In the higher branches the problems of scientific geography are studied, and students are encouraged to develop the geographical aspects of other subjects, such as archæology, history, commerce, colonization on the one hand, botany and natural history on the other. We have moved forwards and upwards, but do not let us flatter ourselves that we have as yet reached any considerable eminence. Probably many more of our countrymen can read a map in this generation than could in the last. A small percentage, I am glad to notice, are not hopelessly bewildered even by contour-lines.

We are learning our geographical alphabet. In time we may, as a nation, be able to read and to understand what we read. We shall recognize that ability to use a map and judge ground is a considerable safeguard against waste of life and disasters in war, and that an acquaintance with the features of the Earth's surface and geographical distribution is an invaluable help in the commercial rivalries and struggles of peace.

When the question of establishing geography at Oxford was being discussed, Dr. Jowett (who had himself somewhere in the fifties suggested the erection of a geographical chair) asked me if I believed geography could be taught so "as to make men think." We should, I believe, "think imperially" to more purpose if we also took pains to "think geographically." But I will not detain you and use up my time by going in any detail into the progress of geography. I might find myself only repeating what others have said better. And as to one important branch, perhaps the most important branch, geographical education, on which I addressed this Section at Birmingham some seventeen years ago, I feel myself debarred by the fact that the Association has now a Section specially devoted to education.

I have determined on the whole, therefore, to run the risk of wearying some of my listeners by inviting your attention to the place in geography of the natural objects which have had for me through life the greatest and most enduring attraction. I propose to talk about mountains, their place in Nature, and their influence, both spiritual and material, on mankind.

We have all of us seen hills, or what we call hills, from the monstrous protuberances of the Andes and the Himalaya to such puny pimples as lie about the edges of your fens. Next to a waterfall, the first natural object (according to my own experience) to impress itself on a child's mind is a hill, some spot from which he can enlarge his horizon. Hills, and still more mountains, attract the human imagination and curiosity. The child soon asks, "Tell me, how were mountains made?" a question easier to ask than to answer, which occupied the lifetime of the father of mountain science, De Saussure. But there are mountains and mountains. Of all natural objects the most impressive is a vast snowy peak rising as a white island above the waves of green hills—a fragment of the arctic world left behind to commemorate its past predominance—and bearing on its broad shoulders a garland of the Alpine flora that has been destroyed on the lower ground by the rising tide of heat and drought that succeeded the last glacial epoch. Midsummer snows, whether seen from the slopes of the Jura or the plains of Lombardy, above the waves of the Euxine or through the glades of the tropical forests of Sikhim, stir men's imaginations and rouse their curiosity. Before, however, we turn to consider some of the physical aspects of mountains, I shall venture, speaking as I am here in a university town, and to a more or less literary audience, to dwell for a few minutes on their place in literature—in the mirror that reflects in turn the mind of the passing ages. For geography is concerned with the interaction between man and Nature in its widest sense. There has been recently a good deal of writing on this subject—I cannot say of discussion, for of late years writers have generally taken the same view. That view is that the love of mountains is an invention of the nineteenth century, and that in previous ages they had been generally looked on either with indifference or positive dislike, rising in some instances to abhorrence. Extreme examples have been repeatedly quoted. We have all heard of the bishop who thought the devil was allowed to put in mountains after the fall of man; of the English scribe in the tenth century who invoked "the bitter blasts of glaciers and the Pennine host of demons" on the violaters of the charters he was employed to draft. The examples on the other side have been comparatively neglected. It seems time they were insisted on.

The view I hold firmly, and which I wish to place before you to-day, is that this popular belief that the love of mountains is a taste, or, as some would say, a mania, of advanced civilization, is erroneous. On the contrary, I allege it to be a healthy, primitive, and almost universal human instinct. I think I can indicate how and why the opposite belief has been fostered by eminent writers. They have taken too narrow a time-limit for their investigation. They have compared the nineteenth century, not with the preceding ages, but with the eighteenth. They have also taken too narrow a space-limit. They have hardly cast their eyes beyond Western Europe. Within their own limits I agree with them. The eighteenth century was, as we all know, an age of formality. It was the age of Palladian porticoes, of interminable avenues, of formal gardens and formal style in art, in literature, and in dress. Mountains, which are essentially romantic and Gothic, were naturally distasteful to it. The artist says "they will not compose," and they became obnoxious to a generation that adored composition, that thought more of the cleverness of the artist than of the aspects of Nature he used as the material of his work. It was a contented and material century, little stirred by enthusiasms and aspirations and vague desires. There is a great deal to be said for it; it produced some admirable results. It was a phase in human progress, but in many respects it was rather a reaction than a development from what had gone before. Sentiment and taste have their tides like the sea, or, we may here perhaps more appropriately say, their oscillations like the glaciers. The imagination of primitive man abhors a void; it peoples the regions it finds uninhabitable with aëry sprites, with "Pan and father Sylvanus and the sister nymphs;" it worships on high places and reveres them as the abode of Deity. Christianity came and denounced the vague symbolism and personification of Nature in which the pagan had recognized and worshipped the Unseen. It found the objects of its devotion, not in the external world, but in the highest moral qualities of man. Delphi heard the cry, "Great Pan is dead!" But the voice was false. Pan is immortal. Every villager justifies etymology by remaining more or less of a pagan. Other than villagers have done the same. The monk driven out of the world by its wickedness fell in love with the wilderness in which he sought refuge, and soon learnt to give practical proof of his love of scenery in his choice of sites for his religious houses. But the literature of the eighteenth century was not written by monks or country folk, or by men of world-wide curiosity and adventure like the Italians of the Renaissance or our Elizabethans. It was the product of a practical common-sense epoch which looked on all waste places, heaths like Hindhead, or hills like the Highlands, as blemishes in the scheme of the universe, not having yet recognized their final purpose as golf-links or gymnasiums. Intellectual life was concentrated in cities and courts; it despised the country. Books were written by townsmen, dwellers in towns which had not grown into vast cities, and whose denizens, therefore, had not the longing to escape from their homes into purer air that we have to-day. They abused the Alps frankly. But all they saw of them was the comparatively dull carriage passes, and these they saw at the worst time of year. Hastening to Rome for Easter, they traversed the Maurienne while the ground was still brown with frost and patched untidily with half-melted snowdrifts. It is no wonder that Gray and Richardson, having left spring in the meadows and orchards of Chambéry, grumbled at the wintry aspect of Lanslebourg.

That at the end of the eighteenth century a literary lady of Western Europe preferred a Paris gutter to the Lake of Geneva is an amusing caricature of the spirit of the age that was passing away, but it is no proof that the love of mountains is a new mania, and that all earlier ages and peoples looked on them with indifference or dislike. Wordsworth and Byron and Scott in this country, Rousseau and Goethe, De Saussure and his school abroad, broke the ice, but it was the ice of a winter frost, not of a glacial period.[*]

Consider for a moment the literature of the two peoples who have most influenced European thought—the Jews and the Greeks. I need hardly quote a book that before people quarrelled over education was known to every child—the Bible. I would rather refer you to a delightful poem in rhyming German verse written in the seventeenth century by a Swiss author, Rebman, in which he relates all the great things that happened on mountains in Jewish history: how Solomon appreciated the charms of Lebanon; how Moses and Elias both disappeared on mountain-tops; how kings and prophets found their help among the hills; how closely the heights of Palestine are connected with the story of the Gospels.

Consider, again, Greece, where I have just been wandering. Did the Greeks pay no regard to their mountains? They seized eagerly on any striking piece of hill scenery and connected it with a legend or a shrine. They took their highest mountain, broad-backed Olympus, for the home of the gods; their most conspicuous mountain, Parnassus, for the home of poetry. They found in the cliffs of Delphi a dwelling for their greatest oracle and a centre for their patriotism. One who has lately stood on the top of Parnassus and seen the first rays of the sun as it springs from the waves of the Ægean strike its snows, while Attica and Bœotia and Eubœa still lay in deep shadow under his feet, will appreciate the famous lines of Sophocles, which I will not quote, as I am uncertain how you may pronounce Greek in this university. You may remember, too, that Lucian makes Hermes take Charon, when he has a day out from Hell, to the twin-crested summit, and show him the panorama of land and sea, of rivers and famous cities. The Vale of Tempe, the deep gap between Olympus and Ossa, beautiful in its great red cliffs, fountains, and spreading plane-trees, was part of a Roman's classical tour. The superb buttresses in which Taygetus breaks down on the valley of the Eurotas were used by the Spartans for other purposes besides the disposal of criminals and weakly babies. The middle regions—the lawns above the Langada Pass, "virginibus bacchata Lacænis Taygeta"—are frequented to this day as a summer resort by Spartan damsels. The very top, the great rock that from a height of 8000 feet looks down through its woods of oaks and Aleppo pines on the twin bays of the southern sea, is a place of immemorial pilgrimage. It is now occupied by a chapel framed in a tiny court, so choked with snow at the beginning of June that I took the ridge of the chapel roof for a dilapidated stoneman. I have no time to-day to look for evidence in classical literature, to refer to the discriminating epithets applied in it to mountain scenes.[†]

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[*] Even in the eighteenth century a great deal of interest was taken in mountain phenomena. M. le Baron de Zurlauben's splendid work, 'Tableaux de la Suisse, published in 1781, has numerous plates illustrating glaciers, and its index contains nearly three long columns of references to them.

[†] Cicero puts together a list of rural delights ('De Naturâ Deorum,' ii. 39), "Fontium gelidas perennitates, liquores pellucidos amnium, riparum vestitus viridissimos, speluncarum concavas altitudines, *saxorum asperitates, impendentium montium altitudines*, immensitatesque camporum." Apuleius, in his treatise 'De Mundo,' arguing in favour of physiography, quotes as amongst the common objects of picturesque description in the second century, "Nysæ juga, et penetralia Coryci, et Olympi sacra, et Ossæ ardua, et alia hujuscemodi."

A third race destined apparently to play a great part in the world's history—the Japanese—are ancient mountain lovers. We are all aware that Fujiyama to the Japanese is (as Ararat to the Armenians) a national symbol; that its ascent is constantly made by bands of pilgrims; that it is depicted in every aspect. Those who have read the pleasant book of Mr. Weston, who, as English chaplain at Kobi for some years, had exceptional opportunities of travel in the interior, will remember how often he met with shrines and temples on the summits of the mountains, and how he found pilgrims who frequented them in the belief that they fell there more readily into spiritual trances. The Japanese Minister, when he attended Mr. Weston's lecture at the Alpine Club, told us that his countrymen never climbed mountains without a serious — that is to say, a religious—object.

India and China would add to my evidence had I knowledge and time enough to refer to their literature. I remember Tennyson pointing out to me in a volume of translations from the Chinese a poem, written about the date of King Alfred, in praise of a picture of a mountain landscape. But I must return to the sixteenth and seventeenth centuries in Europe; I may go earlier—even back to Dante. His allusions to mountain scenery are frequent; his Virgil had all the craft of an Alpine rock-climber. Read Leonardo da Vinci's 'Notes,' Conrad Gesner's ascent of Pilatus; study the narratives of the Alpine precursors Mr. Coolidge has collected and annotated with admirable industry in the prodigious volume he has recently brought out.

It is impossible for me here to multiply proofs of my argument, to quote even a selection from the passages that show an authentic enthusiasm for mountains that may be culled from writers of various nations prior to A.D. 1600. I must content myself with the following specimens, which will probably be new to most of my hearers.

Benedict Marti was a professor of Greek and Hebrew at Bern, and a friend of the great Conrad Gesner (I call him great, for he combined the qualities of a man of science and a man of letters, was one of the fathers of botany as well as of mountaineering, and, in his many-sidedness, a typical figure of the Renaissance). Marti, in the year 1558 or 1559, wrote as follows of the view from his native city:—

"These are the mountains which form our pleasure and delight" (the Latin is better—"deliciæ nostræ, nostrique amores") "when we gaze at them from the higher parts of our city and admire their mighty peaks and broken crags that threaten to fall at any moment. Here we watch the risings and settings of the sun and seek signs of the weather. In them we find food not only for our eyes and our minds, but also for our bellies;" and he goes on to enumerate the dairy products of the Oberland and the happy life of its population. I quote again this good man: "Who, then, would not admire, love, willingly visit, explore, and climb places of this sort? I assuredly should call those who are not attracted by them dolts, stupid dull fishes, and slow tortoises" ("fungos, stupidos insulsos pisces, lentosque chelones"). "In truth, I cannot describe the degree of affection and natural love with which I am drawn to mountains, so that I am never happier than on the mountain crests, and there are no wanderings dearer to me than those on the mountains. . . . They are the theatre of the Lord, displaying monuments of past ages, such as precipices, rocks, peaks and chasms and never-melting glaciers;" and so on through many eloquent paragraphs.

I will only add two sentences from the preface to Simler's 'Vallesiæ et Alpium Descriptio,' first published in 1574, which seem to me a strong piece of evidence in favour of my view: "In the entire district, and particularly in the very lofty ranges by which the Vallais is on all sides surrounded, wonders of Nature offer themselves to our view and admiration. With my countrymen many of them have through familiarity lost their attraction; but foreigners are overcome at the mere sight of the Alps, and regard as marvels what we through habit pay no attention to."

Mr. Coolidge, in his singularly interesting footnotes, goes on to show that the books that remain to us are not isolated instances of a feeling for mountains in the age of the Renaissance. The mountains themselves bear, or once bore, records even more impressive. Most of us have visited the picturesque old castle at Thun and seen beyond the rushing Aar the green heights of the outposts of the Alps, the Stockhorn, and the Niesen. Our friend Marti, who climbed the former peak about 1558, records that he found on the summit "tituli, rythmi, et proverbia saxis inscripta unà cum imaginibus et nominibus auctorum. Inter alia cujusdam docti et montium amœnitate capti observare licebat illud—

"Ὁ τῶν ὅρων ἔρως ἄριστος."

"The love of mountains is best." In those five words some Swiss professor anticipated the doctrine of Ruskin and the creed of Leslie Stephen, and of all men who have found mountains the best companions in life.

In the annals of art it would be easy to find additional proof of the attention paid by men to mountains three to four hundred years ago. The late Josiah Gilbert, in a charming but too little-known volume, 'Landscape in Art,' has shown how many great painters depicted in their backgrounds their native hills. Titian is the most conspicuous example.

It will perhaps be answered that this love of mountains led to no practical result, bore no visible fruit, and therefore can have been but a sickly plant. Some of my hearers may feel inclined to point out that it was left to the latter half of the nineteenth century to found Climbers' Clubs. It would take too long to adduce all the practical reasons which delayed the appearance of these fine fruits of peace and an advanced civilization. I am content to remind you that the love of mountains and the desire to climb them are distinct tastes. They are often united, but their union is accidental, not essential. A passion for golf does not necessarily argue a love of levels. And I would suggest that more outward and visible signs than are generally imagined of the familiar relations between men and mountains in early times may be found. The choicest spots in the Alpine region—Chamonix, Engelberg, Disentis, Einsiedlen, Pesio, the Grande Chartreuse—were seized on by recluses; the Alpine Baths were in full swing at quite an early date. I will not count the Swiss Baden, of which a geographer, who was also a Pope, Æneas Silvius (Pius II.), records the attractions, for it lies under the Jura, not the Alps; but Pfäfers, where wounded warriors went to be healed, was a scene of dissipation, and the waters of St. Moritz were vaunted as superseding wine. I may be excused, since I wrote this particular passage myself a good many years ago, for quoting a few sentences bearing on this point from 'Murray's Handbook to Switzerland.' In the sixteenth century fifty treatises dealing with twenty-one different resorts were published. St. Moritz, which had been brought into notice by Paracelsus (died 1541), was one of the most famous baths. In 1501 Matthew Schiner, the famous Prince Bishop of Sion, built "a magnificent hotel" at Leukerbad, to which the wealthy were carried up in panniers on the back of mules. Brieg, Gurnigel, near Bern, the Baths of Masino, Tarasp, and Pfäfers were also popular in early times. Leonardo da Vinci mentions the baths of Bormio, and Gesner went there.

It is not, however, with the emotional influences or the picturesque aspect of mountains that science concerns itself, but with their physical examination.

If I have lingered too long on my preamble I can only plead as an excuse that a love of one's subject is no bad qualification for dealing with it, and that it has tempted me to endeavour to show you grounds for believing that a love of mountains is no modern affectation, but a feeling as old and as widespread as humanity itself.

Their scientific investigation has naturally been of comparatively modern date. There are a few passages about the effects of altitude, there are orographical descriptions more or less accurate in the authors of antiquity. But for attempts to explain the origin of mountains, to investigate and account for the details of their structure, we shall find little before the notes of Leonardo da Vinci, that marvellous man who combined, perhaps, more than any one who has ever lived the artistic and the scientific mind. His ascent of Monte Boso about 1511, a mountain which may be recognized under this name on the Italian ordnance map on the spur separating Val Sesia and the Biellese, was the first ascent by a physical observer. Gesner, with all his mountain enthusiasm, found a scientific interest in the Alps mainly, if not solely, in their botany.

The phenomenon which first drew men of science to Switzerland was the Grindelwald glaciers—"miracles of Nature" they called them. Why these glaciers in particular, you may ask, when there are so many in the Alps? The answer is obvious. Snow and ice on the "mountain-tops that freeze" are no miracle. But when two great tongues of ice were found thrusting themselves down among meadows and corn and cottages, upsetting barns and covering fields and even the marble quarries from which the citizens of Bern dug their mantelpieces, there was obviously something outside the ordinary processes of Nature, and therefore miraculous.

Swiss correspondents communicated to our own Royal Society the latest news as to the proceedings of these unnatural ice-monsters, while the wise men of Zürich and Bern wrote lectures on them. Glacier theories began. Early in the eighteenth century Hottinger, Cappeller, Scheuchzer, that worthy man who got members of our Royal Society to pay for his pictures of flying dragons, contributed their quota of crude speculation. But it was not till 1741 that Mont Blanc and its glaciers were first brought into notoriety by our countrymen, Pococke and Windham, and became an attraction to the mind and an object to the ambition of the student whose name was destined to be associated with them. Horace Benedict de Saussure, born of a scientific family, the nephew of Bonnet, the Genevese botanist and philosopher, who has become known to the world as a mountaineer and the climber of Mont Blanc, came twenty years later. In truth he was far more of a mountain traveller and a scientific observer, a geological student, than a climber. When looking at his purple silk frock-coat (carefully preserved in his family's country home on the shore of the Lake of Geneva), one realizes the difference between the man who climbed Mont Blanc in that garment and the modern gymnast who thinks himself *par excellence* the mountaineer.

De Saussure did not confine his travels to Savoy or to one group; he wandered far and wide over the Alpine region, and the four volumes of his 'Voyages' contain, besides the narratives of his sojourn on the Col du Géant and ascent of Mont Blanc, a portion of the fruit of these wanderings.

The reader who would appreciate De Saussure's claim as the founder of the Scientific Exploration of Mountains must, however, be referred to the List of Agenda on questions calling for investigation placed at the end of his last volume. It explains the comparative indifference shown by De Saussure to the problems connected with glacial movement and action. His attention was absorbed in the larger question of earth-structure, of geology, to which the sections exposed by mountains offered, he thought, a key; he was bitten by the contemporary desire for "A Theory of the Earth," by the taste of the time for generalizations for which the facts were not always ready. At the same time, his own intellect was perhaps somewhat deficient in the intuitive faculty; the grasp of the probable or possible bearing of known facts by which the greatest discoverers suggest theories first and prove them afterwards.

The school of De Saussure at Geneva died out after having produced Bourrit, the tourist who gloried in being called the Historian of the Alps, a man of pleasant self-conceit and warm enthusiasm, and De Luc, a mechanical inventor, who ended his life as reader to Queen Charlotte at Windsor, where he flits across Miss Burney's pages as the friend of Herschel at Slough and the jest of tipsy royal dukes. Oddly enough, the first sound guess as to glacier movement was made by one Bordier, who had no scientific pretensions. I reprinted many years ago the singular passage in which he compared glacier ice to "cire amollie," soft wax, "flexible et ductile jusqu'à un certain point," and described it as flowing in the manner of liquids (*Alp. Journal*, ix. 327). He added this remarkable suggestion foreshadowing the investigations of Prof. Richter and M. Forel: "It is very desirable that there should be at Chamonix some one capable of observing the glaciers for a series of years and comparing their advance and oscillations with meteorological records." To the school of Geneva succeeded the school of Neuchatel, Desor, and Agassiz; the feat of De Saussure was rivalled on the Jungfrau and the Finsteraarhorn by the Meyers of Bern. They in turn were succeeded by the British school, Forbes and Tyndall, Reilly and Wills, in 1840–60.

In 1857 the Alpine Club was founded in this country. In the half-century since that date the nations of Western Europe have emulated one another in forming similar bodies, one of the objects of which has been to collect and set in order information as to the mountains, and to further their scientific as well as their geographical exploration.

What boulders, or rather pebbles, may we profitably add to the enormous moraine of modern Alpine literature—a moraine of which it is to be hoped for the sake of posterity that the torrent of time may speedily make away with some of the lighter portions.

For fifty years I have loved and at frequent intervals wandered and climbed in the Alps. I have had something of a grand passion for the Caucasus. I am on terms of visiting acquaintance with the Pyrenees and the Himalaya, the Apennines and the Algerian Atlas, the mountains of Greece, Syria, Corsica, and Norway. I will try to set in order some observations and comparisons suggested by these various experiences.

As one travels east from the Atlantic through the four great ranges of the Old World the peaks grow not only in absolute height, but also in abruptness of form, and in elevation above the connecting ridges. The snow and ice region increases in a corresponding manner. The Pyrenees have few fine rockpeaks except the Pic du Midi d'Ossau; their chief glacier summits, the Vignemale, Mont Perdu, the Maladetta, correspond to the Titlis or the Buet in the Alps. The peaks of the Alps are infinite in their variety and admirable in their clear-cut outlines and graceful curves. But the central group of the Caucasus, that which culminates in Dykhtau, Koshtantau, and Shkara, 17,000-feet summits (Koshtantau falls only 120 feet below this figure), has even more stately peaks than those that cluster round Zermatt.

Seek the far eastern end of the Himalaya, visit Sikhim, and you will find the scale increased; Siniolchum, Jannu, and Kangchenjunga are all portentous giants. To put it at a low average figure, the cliffs of their final peaks are half as high again as those of Monte Rosa and the Matterhorn.

In all these chains you will find the same feature of watersheds or partings lying not in but behind the geological axis. This is the case in the Alps at the St. Gotthard, in the Caucasus for some 40 miles west of the Dariel pass, in the Himalaya, in Sikhim and Nepal, where the waters flowing from the Tibetan plateau slowly eat their way back behind Kangchenjunga and the Nepalese snows. The passes at their sources are found consequently to be of the mildest character, hills "like Wiltshire downs," is the description given by a military explorer. It needs no great stretch of geological imagination to believe in the cutting back of the southern streams of Sikhim or the Alps, as, for instance, at the Maloya; but I confess that I cannot see how the gorges of Ossetia—clefts cut through the central axis of the Caucasus—can be ascribed mainly to the action of water.

I turn to the snow-and-ice region. Far more snow is deposited on the heights of the Central Caucasus and the Eastern Himalaya than on the Alps. It remains plastered on their precipices, forming hanging glaciers everywhere of the kind found on the northern, the Wengern Alp, face of the Jungfrau. Such a peak as the Weisshorn looks poor and bare compared with Tetnuld in the Caucasus or Siniolchum in the Himalaya. The plastered sheets of snow between their great bosses of ice are perpetually melting; their surfaces are grooved, so as to suggest fluted armour, by tiny avalanches and runnels.

In the Aletsch glacier the Alps have a champion with which the Caucasus cannot compete; but, apart from this single exception, the Caucasian glaciers are superior to the Alpine in extent and picturesqueness. Their surfaces present the features familiar to us in the Alps—icefalls, moulins, and earthcones.

In Sikhim, on the contrary, the glaciers exhibit many novel features, due no doubt mainly to the great sun-heat. In the lower portion their surface is apt to be covered with the *débris* that has fallen from the impending cliffs, so that little or no ice is visible from a distance. In the region below the *névé* there are very few crevasses; the ice heaves itself along in huge and rude undulations, high gritty mounds, separated by hollows often occupied by yellow pools which are connected by streams running in little icy ravines—a region exceptionally tiresome, but in no way dangerous to the explorer. In steep places the Alpine icefall is replaced by a feature I may best compare with a series of earth-pillars such as are found near Evolena and elsewhere, and are figured in most textbooks. The ice is shaped into a multitude of thin ridges and spires, resembling somewhat the Nieves Penitentes of the Andes—though formed in a different material.

Great sun-heat acting on surfaces unequally protected, combined in the latter case with the strain of sudden descent, is no doubt the cause of these phenomena. Generally the peculiarities of the great glaciers of Kangchenjunga may be attributed to a fiercer sun, which renders the frozen material less liable to crack, less rigid, and more plastic.

A glacier, as a rule, involves a moraine. Now, moraines are largely formed from the material contributed by sub-aërial denudation—in plain words, by the action of heat and cold and moisture on the cliffs that border them. It is what falls on a glacier, not that which it falls over, that mainly makes a moraine. The proof is that the moraines of a great glacier which flows under no impending cliffs are puny, compared with those of a little one that lies beneath great rockwalls.

Take, for example, the Norwegian glaciers of the Jostedal's Brae and compare them with the Swiss. The former, falling from a great *névé* plain or snowfield, from which hardly a crag protrudes, are models of cleanliness. I may cite as examples the three fascinating glaciers of the Olden valley. The Rosenlaui glacier in Switzerland owed the purity which gave it a reputation fifty years ago, before its retirement from tourists' tracks, to a similar cause—its source in a vast snow-plateau, the Wetterkessel.

One peculiarity very noticeable both in the Himalaya and the Caucasus I have never found satisfactorily accounted for. I refer to the long grassy trenches lying between the lateral moraine and the mountain-slope, which often seem to the explorer to have been intended by Providence to form grass paths for his benefit. They may possibly be due to the action of torrents falling from the hillside, which, meeting the moraine and constantly sweeping along its base, undermine it and keep a passage open for themselves. There are remarkable specimens of this formation on both sides of the Bezingi glacier, in the Caucasus, and on the north side of the Zemu glacier in Sikhim.

Water is one of the greatest features in mountain scenery. In Norway it is omnipresent. In this respect Scandinavia is a region apart; the streams of the more southern ranges are scanty compared with those of a region where the snowfall of two-thirds of the year is discharged in a few weeks. Greece stands at the opposite pole. By what seems a strange perversity of Nature, its slender streams are apt to disappear underground, to reissue miles away in the great fountains that gave rise to so many legends. Arcadia is, for the most part, a dry upland, sadly wanting in the two elements of pastoral scenery, shady groves, and running brooks.

The Alps are distinguished by their sub-alpine lakes—

> "Anne lacus tantos; te, Lari maxime, teque
> Fluctibus et fremitu assurgens, Benace, marino?"

of Virgil. But perhaps even more interesting to the student are the lake-basins that have been filled up, and thus suggest how similar lakes may have vanished at the feet of other ranges.

I know no more striking walk to any one interested in the past doings of glaciers than that along the ridge of the mighty moraine of the old glacier of Val d'Aosta, which sweeps out, a hill 500 feet high, known as "La Serra," from the base of the Alps near Ivrea into the plain of Piedmont. Enclosed in its folds still lies the Lago di Viverone; but the Dora has long ago cut a gap in the rampart and drained the rest of the enclosed space, filling it up with the fluvial deposit of centuries.

It is, however, the tarns rather than the great lakes of the Alps which have been the chief subjects of scientific disputation. Their distribution is curious. They are found in great quantity in the Alps and Pyrenees, hardly at all in the Caucasus, and comparatively rarely in the part of the Himalaya I am acquainted with.

A large-scale map will show that where tarns are most thickly dotted over the uplands the peaks rise to no great height above the ridges that connect them. This would seem to indicate that there has been comparatively little sub-aërial denudation in these districts, and consequently less material has been brought down to fill the hollows. Again, it is in gneiss and granitic regions that we find tarns most abundant—that is, where the harder and more compact rocks make the work of streams in tapping the basins more lengthy. The rarity of tarns in the highlands behind Kangchenjunga, perhaps, calls for explanation. We came upon many basins, but, whether formed by moraines or true rock-basins, they had for the most part been filled up by alluvial deposits.

In my opinion, the presence of tarns must be taken as an indication that the portion of the range where they are found has until a comparatively recent date been under snow or ice. The former theory, still held, was that the ice scooped out their basins from the solid rock. I believe that it has simply kept scoured pre-existing basins. The ice removed and the surrounding slopes left bare, streams on the one hand have filled the basins with sediment, or, on the other, tapped them by cutting clefts in their rims. This theory meets, at any rate, all the facts I have observed, and I may point out that the actual process of the destruction of tarns by such action may be seen going on under our eyes in many places, notably in the glens of the Adamello group. Professor Garwood has lately employed his holidays in sounding many of the tarns of the St. Gotthard group, and his results, I understand, tend to corroborate the conclusions just stated.

I desire here to reaffirm my conviction that snow and ice in the High Alps are conservative agents; that they arrest the natural processes of subaërial denudation; that the scouring work done by a glacier is insignificant compared with the hewing and hacking of frost and running water on slopes exposed to the open sky without a roof of *névé* or glacier.

The contrast between the work of these two agents was forced upon me many years ago while looking at the ground from which the Eiger glacier had then recently retreated. The rocks, it is true, had had their angles rubbed off by the glacier, but through their midst, cut as by a knife, was the deep slit or gash made by the subglacial torrent. There is in the Alps a particular type of gorge, found at Rosenlaui, at the Lower Grindelwald glacier, at the Kirchet above Meiringen, and also in the Caucasus, within the curves of old terminal moraines. It is obviously due to the action of the subglacial torrent, which cuts deeper and deeper, while the ice above protects the sides of the cutting from the action of the atmosphere.

One more note I have to make about glaciers. It has been stated that glaciers go on melting in winter. Water, no doubt, flows from under some of them, but that is not the same thing. In January the end of the Rosenlaui glacier is dry; you can jump across the clear stream that flows from the Lower Grindelwald glacier. That stream is not meltings, but the issue of a spring which rises under the glacier and does not freeze. There is another such stream on the way to the Great Scheideck, which remains free when frost has fettered all its neighbours.

I should like to draw your attention before we leave glaciers to the systematic efforts that are being made on the Continent to extend our knowledge of their peculiarities. The subject has a literature of its own, and two societies—one in France, one in other countries—have been constituted to promote and systematize further investigations, especially with regard to the secular and annual oscillations of the ice. These were initiated by the English Alpine Club in 1893, while I was its president. Subsequently, through the exertions of the late Marshall Hall, an enthusiast on the subject, an International Commission of Glaciers was founded, which has been presided over by Dr. Richter, M. Forel, and others; and more recently a French Commission has been created with the object of studying in detail the glaciers of the French Alps. A number of excellent reports have been published, embodying information from all parts of the globe. There has been, and is, I regret to say, very great difficulty in obtaining any methodical reports from the British possessions oversea. The subject does not commend itself to the departmental mind. Let us hope for improvement: I signalize the need for it. Of course, it is by no means always an easy matter to get the required measurements of retreat or advance in the glacial snout, when the glacier is situated in a remote and only casually visited region. Still, with good-will more might be done than has been. The periods of advance and retreat of glaciers appear to correspond to a certain extent throughout the globe. The middle of the last century was the culmination of the last great advance. The general estimate of their duration appears to be half a century. The ice is now retreating in the Alps, the Caucasus, and the Himalaya, and I believe in North America. We live in a retrogressive period. The minor oscillation of advance which a few years ago gave hopes to those who, like myself, had as children seen the glaciers of Grindelwald and Chamonix at their greatest, has not been continued.

Attempts are made to connect the oscillations of glaciers with periods of sunspots. They are, of course, connected with the rain or snowfall in past seasons. But the difficulty of working out the connection is obvious.

The advance of the glacier will not begin until the snows falling in its upper basin have had time to descend as ice and become its snout; in each glacier this period will vary according to its length, bulk, and steepness, and the longer the glacier is, the slower its lower extremity will be to respond. Deficiency in snowfall will take effect after the same period. It will be necessary, therefore, to ascertain (as has been done in a tragic manner on Mont Blanc by the recovery in the lowest portion of the Glacier des Bossons of the bodies of those lost in its highest snows) the time each glacier takes to travel, and to apply this interval to the date of the year with which the statistics of deposition of moisture are to be compared. If the glacier shows anything about weather and climate, it is past, not contemporary, weather it indicates.

Another point in which the Asiatic ranges, and particularly the Himalaya, differ from the Alps is in the frequency of snow avalanches, earthfalls, and mud-slides. These are caused by the greater deposition of snow and the more sudden and violent alternations of heat and cold, which lead to the splitting of the hanging ice and snows by the freezing of the water in their pores. I have noticed at bivouacs that the moment of greatest cold—about the rising of the morning star—is often hailed by the reports of a volley of avalanches.

The botanist may find much to do in working out a comparison of the flora of my four ranges. I am no botanist: I value flowers according, not to their rarity, but to their abundance, from the artist's, not the collector's, point of view. But it is impossible not to take interest in such matters as the variations of the gentian in different regions, or the behaviour of such a plant as the little Edelweiss (once the token of the Tyrolese lover, now the badge and bane of the Alp-trotter), which frequents the Alps, despises the Caucasus, reappears in masses in the Himalaya, and then, leaping all the isles of the tropics, turns up again under the snows of New Zealand. I may mention that it is a superstition that it grows only in dangerous places. I have often found it where cows can crop it; it covers acres in the Himalaya, and I believe it has been driven by cows off the Alpine pastures, as it is being driven by tourists out of the Alps altogether.

The Italian botanists, MM. Levier and Sommier, have given a vivid account of what they call the Makroflora of the Central Caucasus—those wild-flower beds, the product of sudden heat on a rich and sodden soil composed of the vegetable mould of ages, in which a man and horse may literally be lost to sight. Has any competent hand celebrated the Mikroflora of the highest ridges, those tiny, vivid forget-me-nots and gentians and ranunculuses that flourish on rock-island "Jardins" like that of Mont Blanc, among the eternal snows, and enamel the highest rocks of the Basòdino and the Lombard Alps? A comprehensive work on a comparison of mountain flora and the distribution of Alpine plants throughout the ranges of the Old World would be welcome. We want another John Ball. Allied to botany is forestry, and the influence of trees on rainfall, and consequently the face of the mountains, a matter of great importance, which in this country has hardly had the attention it deserves.

From these brief suggestions as to some of the physical features of mountains I would ask you to turn your attention to the points in which mankind come in contact with them, and first of all to history.

I fancy that the general impression that they have served as efficient barriers is hardly in accordance with facts, at any rate from the military point of view. Many great captains—Hannibal, Hasdrubal, Cæsar, Charles the Great, and Napoleon—passed the Alps successfully. Hannibal, it is true, had some difficulty, but then he was handicapped with elephants. Many years ago I showed that Servius, the greatest authority in Rome in the days of Augustus, had no doubt as to where Hannibal crossed the Alps, and proved that it was not by any Aostan pass.* The Holy Roman emperors constantly moved forwards and backwards. Burgundy, as the late Mr. Freeman was never weary of insisting, lay across the Alps. So till our own day did the dominions of the House of Savoy. North Italy has been in frequent connection with Germany; it is only in my own time that the Alps have become a frontier between France and Italy. But questions of this kind might lead us too far. Let me suggest that some competent hand should compose a history of the Alpine passes and their famous passages, more complete than the treatises that have appeared in Germany. Mr. Coolidge, to whom we owe so much, has, in his monumental collection and reprint of early Alpine writers, just published, thrown great light on the extensive use of what I may call the by-passes of the Alps in early times. Will he not follow up his work by treating of the Great Passes? I may note that the result of the construction of carriage roads over some of them was to concentrate traffic; thus the Saas passes and the Gries were practically deserted for commercial purposes when Napoleon opened the Simplon. The roads over the Julier and Maloya ruined the Septimer. Another hint to those engaged in tracing ancient lines of communication. In primitive times, in the Caucasus to-day, the tendency of paths is to follow ridges, not valleys. The motives are on the spot obvious—to avoid torrents, swamps, ravines, earthfalls, and to get out of the thickets and above the timber-line. The most striking example is the entrance to the great basin of Suanetia, which runs not up its river, the Ingur, but across a ridge of over 9000 feet, closed for eight months in the year to animals.

From the military point of view mountains are now receiving great attention in Central Europe. The French, the Italians, the Swiss, the Austrians have extensive Alpine manœuvres every summer, in which men, mules, and light artillery are conveyed or carried over rocks and snow. Officers are taught to use maps on the spot; the defects in the official surveys are brought to light. It is not likely, perhaps, except on the Indian frontier, that British troops will have to fight among high snowy ranges. But I feel sure that any intelligent officer who is allowed to attend such manœuvres might pick up valuable hints as to the best equipment for use in steep places. Probably the Japanese have already sent such an envoy and profited by his experience.

A word as to maps, in which I have taken great interest, may be allowed me. The ordnance maps of Europe have been made by soldiers, or under the supervision of soldiers. At home when I was young, it was dangerous to hint at any defects in our ordnance sheets, for surveyors in this country are a somewhat sensitive class. Times have altered, and they are no longer averse from receiving hints and even help from unofficial quarters. Since the great surveys of Europe were executed, knowledge has increased, so that every country has had to revise or re-execute its surveys. In three points that concern us there was great room for improvement—the delineation of the upper region as a whole, and the definition of snow and glaciers in particular, and in the selection of local names. In the two former the Federal Staff at Bern has provided us with an incomparable model. The number of local names known to each peasant is small, his pronunciation is often obscure and each valley is apt to have its own set of names for the ridges and gaps that form its skyline. Set a stranger, speaking another tongue than the local *patois*, to question a herdsman, and the result is likely to be unsatisfactory. It has often proved so. The Zardezan is an odd transcription of the Gias del Cian of *patois*, the Gîte du Champ in French. Grand Paradis is probably a corruption of Granta Parei, an apt description of the great screen of rock and ice of the highest mountain in Italy, though that name is now given to a neighbouring peak. The Pointe de Rosablanche was formerly the Roesa Bianca, or white glacier. Monte Rosa herself, though the poet sees a reference to the rose of dawn, and the German professor detects "the Keltic *ros*, a promontory," is a simple translation of the Gletscher Mons of Simler, or rather Simler's hybrid term is a translation of Monte della Roesa. Roesa, or Ruize, is the Val d'Aostan word for glacier, and may be found in De Saussure's 'Voyages.'

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* See *Alpine Journal*, Nos. 81, 89; *P.R.G.S.*, October, 1886, and May, 1899.

An important case in this matter of mountain nomenclature has recently come under discussion—that of the highest mountain in the world. Most, if not all, mountaineers regret that the name of a Surveyor-General, however eminent, was fifty years ago affixed to Mount Everest. The ground for this action on the part of the Survey was the lack of any native name. Some years ago I ventured to suggest that the 29,002-feet peak (No. XV. of the Survey) was probably visible from the neighbourhood of Katmandu, even though the identifications of it by Schlagintweit and others might be incorrect, and that since some at least of the summits of the snowy group east of that city are apparently known in Nepal as Gaurisankar, that name might, following the practice which gave its name to Monte Rosa in the Alps, legitimately be applied to the loftiest crest of the mountain group of which the Nepalese Gaurisankar formed a part.

Recently, by the kindness of Lord Curzon, acting on a suggestion of my own, Captain Wood, a Survey officer, has been deputed to visit Katmandu and ascertain the facts. He has found that, contrary to the opinion of the late General Walker and the assertion of Major Waddell, Peak XV. is visible from the hills round the capital, and that the two highest snow-peaks visible from the city itself in the same direction were known to the Nepalese "nobles" as Gaurisankar.*

These latter peaks or peak are about 36 miles distant from Peak XV., but are connected with it by a continuous line of glaciers. According to the principles that have prevailed in the division of the Alps, they would undoubtedly be considered as part of the same group, and the name, which, according to Captain Wood, is applied to a portion of the group, might legitimately be adopted for its loftiest peak.

But the chiefs of the Indian Survey take, as they are entitled to, a different view. They have decided to confine the name Gaurisankar to one of the peaks seen from Katmandu itself. I do not desire to raise any further protest against this decision. For since, in 1886, I first raised the question, its interest has become mainly academical. A local Tibetan name for Peak XV., Chomo-Kankar, the Lord of Snows, has been provided on excellent native authority, confirmed by that competent Tibetan scholar, Major (now Colonel) Waddell, and I trust this name may in the future be used for the highest mountain in the world. The point at issue is mainly one of taste. Indian surveyors may see no incongruity in naming after one of their own late chiefs the highest mountain in the world. But in this view they are, I believe, in a small minority.*

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* See 'Report on the Identification and Nomenclature of the Himalayan Peaks as seen from Katmandu, Nepal.' By Captain H. Wood, R.E., with Preface by Colonel St. G. Gore, C.S.I., R.E. Calcutta: 1904. 8vo.

I would urge mountain explorers to attempt in more distant lands what the late Messrs. Adams-Reilly and Nichols, Mr. Tuckett, and Lieut. Payer (of Arctic fame) did forty years ago with so much success in the Alps, what the Swiss Alpine Club have done lately—take a district, and working from the trigonometrically fixed points of a survey, where one exists, fill it in by planetabling with the help of the instruments for photographic and telephotographic surveying, in the use of which Mr. Reeves, the map curator to the R.G.S., is happy to give instruction. An excellent piece of work of this kind has been done by Mr. Stein in Central Asia.

There are, I know, some old-fashioned persons in this country who dispute the use of photography in mountain work. It can only be because they have never given it a full and fair trial with proper instruments.

Lastly, I come to a matter on which we may hope before long to have the advantage of medical opinion, based for the first time on a large number of cases. I refer to the effects of high altitudes on the human frame and the extent of the normal diminution in force as men ascend. The advance to Lhasa ought to do much to throw light on this interesting subject. I trust the Indian Government has taken care that the subject shall be carefully investigated by experts. The experience of most mountaineers (including my own) in the last few years has tended to modify our previous belief that bodily weakness increases more or less regularly with increasing altitude. Mr. White, the Resident in Sikhim, and my party both found on the borders of Tibet that the feelings of fatigue and discomfort that manifested themselves at about 14,000 to 16,000 feet tended to diminish as we climbed to 20,000 or 21,000 feet. I shall always regret that when I was travelling in 1899 on the shoulders of Kangchenjunga the exceptional snowfall altogether prevented me from testing the point at which any of our ascents were stopped by discomforts due to the atmosphere. Owing to the nature of the footing, soft snow lying on hard, it was more difficult to walk uphill than on a shingly beach; and it was impossible for us to discriminate between the causes of exhaustion.

Here I must bring this, I fear, desultory address to an end. I might easily have made it more purely geographical, if it is geography to furnish a mass of statistics that are better and more intelligibly given by a map. I might have dwelt on my own explorations in greater detail, or have summarized those of my friends of the Alpine Club. But I have done all this elsewhere in books or reviews, and I was unwilling to inflict it for a second time on any of my hearers who may have done me the honour to read what I have written. Looking back, I find I have been able to communicate very little of value, yet I trust I may have suggested to some of my audience what opportunities mountains offer for scientific observations to mountaineers better qualified in science than the present speaker, and how far we scouts or pioneers are from having exhausted even our Alpine playground as a field for intelligent and systematic research.

And even if the value to others of his travels may be doubtful, the Alpine explorer is sure of his reward. What has been said of books is true also of mountains—they are the best of friends. Poets and geologists may proclaim—

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* See, for more recent discussions of this question in periodicals, *Proceedings of the Royal Geographical Society*, N.S., 1885, vii., 753; 1886, viii., 88, 176, 257; 1891, xiii., 108; *Geographical Journal*, 1903, xxi., 294; 1904, xxiii., 89; xxiv., 356; *Alpine Journal*, 1886, xii., 438; 1902-3, xxi., 33, 317; 1904, xxii., 56; *Petermanns Mitteilungen*, 1888, xxxiv., 338; 1890, xxxvi., 251; 1901, xlvii., 40, 289; 1902, xlviii., 14.

"The hills are shadows, and they flow
From form to form, and nothing stands."

But for us creatures of a day the great mountains stand fast, the Jungfrau and Mont Blanc do not change. Through all the vicissitudes of life we find them sure and sympathetic companions. Let me conclude with two lines which I found engraved on a tomb in Santa Croce at Florence—

"Huc properate, viri, salebrosum scandite montem,
Pulchra laboris erunt præmia, palma, quies."

GEOGRAPHY AT THE BRITISH ASSOCIATION, CAMBRIDGE MEETING.

While the Geographical section was not thrilled by stirring adventure or revolutionary theory, the papers were all of considerable interest; but the purely scientific side of geographical work was less prominent than in some recent meetings. The admirable presidential address on Mountains and Mankind with which Mr. Freshfield opened the proceedings will be found on the previous pages. Of the papers about little or unknown parts of the Earth, Mr. Bruce's account of the excellent work done by the Scottish National Antarctic Expedition, and Major Burdon's sympathetic and illuminating description of the Fulani Emirates of Northern Nigeria, were the most important.

The papers may be divided into those dealing with (*a*) England and Wales, (*b*) the Mediterranean basin, (*c*) British lands beyond the seas, (*d*) other travel papers, (*e*) glacier and high mountain areas, (*f*) surveying and cartography.

(*a*) *England and Wales.*—Dr. Mill showed the map of England and Wales with the names of the physical features which Mr. Chisholm, Mr. Mackinder, and he ultimately agreed upon, and which have been adopted by the Royal Geographical Society. This map will be of great service, more especially after a few modifications are made which the inquiry into the usages of various localities and the detailed study of different natural regions will undoubtedly suggest. Mr. Whitaker pointed out one or two of these at the meeting.

Mr. Yule Oldham showed how the conditions of the Fen district had been altered by the cutting of the old and new Bedford rivers, and the construction of the great Denver sluice. This diverted the tide up the new channel, whereas formerly it passed up the Ouse almost to Cambridge, and in the unregulated days was largely responsible for the marshiness of the Fens, which have been drained since this was altered. The old river-course is indicated by the county boundary between Cambridgeshire and Norfolk. Fen vegetation in the present drained area, but more particularly in the few remaining undrained patches, was treated in a paper clearly illustrated by beautiful slides by Mr. R. H. Yapp. The Rev. Alfred Hunt identified the site of the battle of Brunanburh, where Athelstan conquered Anlaff and Constantine, and secured the supremacy of Southern England, with Burnham in north Lincolnshire, four miles south of Barrow Haven. As earthworks of Danish form exist at Barrow Haven, it may have been Anlaff's landing-place.

(*b*) *The Mediterranean Basin.*—Mr. Günther's paper, dealing with changes of sea-level, due to oscillation of the land, has already been published in the *Journal* (August and September, 1903). He cited some new evidence from Genoa, which was supplemented by Mr. R. D. Oldham, for the south of France. Mr. J. Y. Buchanan instanced caves above sea-level, near Monaco, one of which has recently been explored by the liberality of the Prince of Monaco, but he thought that Mr.

Günther should not reject absolutely all considerations of changes in volume of the Mediterranean waters. Mr. D. G. Hogarth's paper on Cyrenaica also contained evidence of changes in the coast-line since classical times, and showed how much a keen observer could make of a short visit of less than a week to a spot of so great historical significance. Dr. Tempest Anderson has recently continued his volcanic studies at the Lipari Islands, and he showed a very beautiful set of lantern slides, which he explained. This was one of the special afternoon lectures, which were this year substituted in this and some other sections for more technical papers. The other was given by Mr. Silva White, on scenes and studies in the Nile valley, and was full of admirably expressed descriptions, both of the valley itself and of the surrounding desert. The word painting of the desert scenes was especially vivid and impressed all who heard it.

(c) *British Lands.*—The account of the Fulani Emirates of Northern Nigeria by the Resident of Sokoto, Major J. A. Burdon, will appear in full in the *Journal.*

Mr. Lepper's notes on the Malabar coast of India dealt with all aspects of the geography of the 30 to 60 miles wide coast strip between 8° and 16° N. In describing the physical features, the author dwelt especially on the remarkable system of rivers, lagoons, and canals which stretch throughout Travancore, Cochin, and the Malabar district for about 200 miles. These inland waters did much to facilitate communication on a coast on which marine navigation was practically suspended during the south-west monsoon, the breaking of which was vividly described. The value of the vegetable products was insisted on, and a sketch given of the puzzling ethnological conditions of the country. The population was described as essentially Dravidian, modified by Aryan (Brahman) settlers, through the prevalence of the matriarchal family system. The style of architecture was quite distinct from any other style in India. In conclusion, the author pointed out the astonishing progress which had been made in the Malabar Coast States during the last fifty years, and insisted on the need of firm but tactful and sympathetic treatment of old institutions, of efficiency, honesty, and continuity in administration.

(d) *Other Travel Papers.*—Mr. Arthur W. Hill described a journey round Lake Titicaca made during the spring of 1903, which is the rainy season on the plateau. From La Paz, the capital of Bolivia, the route lay along the southern shore of the lake to Tiahuanaco, where there exist some of the finest and most ancient stone monuments in South America; thence to the Desaguadero, the only stream flowing out of the lake, and across this, going eastward to Copacabana. Here some stay was made, and the sacred island of Titicaca, with its Inca temples and palaces, was visited. The ancient terraced hillsides were still cultivated with barley, potatoes, quinoa (*Chenopodium*), ocas (*Oxalis*), and beans; wheat and maize could only be grown in sheltered spots at this elevation. The narrow straits of Tiquina were crossed and the journey continued along the north-eastern shore of the lake, with digressions into the eastern mountains, and plants were collected up to about 16,500 feet. The majority of the plants showed a striking uniformity as regards their vegetative habit, they grow usually in rosettes or mounds, had long tap roots, which enabled them to absorb water from the warmer soil at a considerable distance below the surface, and their leaves were usually linear and often hairy. These peculiarities were induced by the climatic conditions, since the plants had to endure a burning sun during the day, followed by frost at night, with cold, cutting winds; there being often a difference in temperature of as much as 70° Fahr. in a few hours. The journey was continued round the northern end of the lake, where the Indian huts are built of mud bricks in the shape of beehives, and was terminated at the Peruvian port of Puno, whence runs the railway to Arequipa and Mollendo.

Mr. W. S. Bruce had a crowded audience to listen to his account of the Scottish

Antarctic Expedition. The skilful way in which the leader and his captain had successfully carried out the work planned, the decision not to winter in the ice, and the absence of any sledge-work on the land were no doubt largely responsible for the absence of thrilling tales of adventure which are usually associated with polar exploration. An outline of the course of the expedition has already appeared in the *Journal*, and of course it will be months if not years before the oceanographical, meteorological, magnetic, biological, and other data are discussed, and the contribution of the expedition to our knowledge of the Antarctic regions properly estimated.

(*e*) *Glacier and High Mountain Areas.*—It was fitting, with Mr. Freshfield as president, that particular attention should be paid to geographical work done by mountaineers. Mr. Maurice de Déchy's communication on the glaciers of the Caucasus will be published in the *Journal.*

Mr. Charles Rabot's account of glacier-bursts, which have in many cases greatly modified the topography within a valley, will also appear in the *Journal.*

Mr. A. W. Andrews' address on the Passes of the Alps was drawn up from the educational point of view, as a geographical object-lesson. He put together in the form of lantern-slides a series of physical and political maps of the Alps and their main sub-divisions, river basins, railways, passes, etc., with beautiful views of typical scenery, which gave some idea to those who had not travelled of the geographical conditions that prevailed in such a region. This was only one of a series of geographical object-lessons he was preparing.

(*f*) *Surveying and Cartography.*—Major Close communicated an outline of methods of topographical surveying, a subject on which he will, we hope, develop his views at a future meeting of the research department of the Society. Mr. C. R. Beazley dealt with the first true maps, and discussed the origin and authors of the portolani of the early fourteenth century. The Rev. H. S. Cronin outlined the way in which he conceived Ptolemy constructed his map of Asia Minor, in a paper which will shortly appear in the *Journal.*

Committees.—The Terrestrial Wave Committee Report, drawn up by Dr. Vaughan Cornish, gave a photograph and description of a roll-wave which moves downstream faster than the current—a form sometimes found in the Tees. The committee asked, and was to be, reappointed.

A committee was appointed without a grant to carry out an investigation into the changes of sea-level in the Mediterranean basin.

A committee, recommended by the Geological and Geographical sections, was appointed without a grant to collect information about the exact meaning and extension of local terms applied to different geographical and geological forms. Information should be sent to the secretary, Mr. Fearnsides.

A committee, recommended by the Geographical and Zoological sections, was appointed with a grant of £150 for the investigation of the geographical and biological conditions of the Indian ocean. Mr. J. Stanley Gardiner is secretary, and proposes to conduct a new expedition to those waters at an early date.

Papers of Special Geographical Interest in other Sections.—Dr. J. E. Marr, who was one of the editors of the excellent 'Natural History of Cambridgeshire,' supplied to members, gave an address on the geology, and Mr. Whitaker read a paper on the wells of the county in Section C. Mr. Harmer's communication on the Great Eastern glacier, and Mr. Spiller's on the erosion of the Suffolk coast—Dunwich to Covehithe—were other papers of local geographical interest. The river capture of the Don system has been traced by the Rev. W. Lower Carter, and an abstract of his paper will appear in the *Journal.* The interesting discussion on the nature and origin of Earth movements in the Geological section led to no very definite conclusions on this vexed difficult subject. Mr. J. A. Hutton's paper on "Cotton-growing in the Empire" was of geographical as well as economic importance, for the geographical aspect is of fundamental importance in the problem of the extension of the cotton-producing area. Mr. J. A. Baines discussed the distribution of rural population in India, in Section F. The proposed barrage of the Thames, on which Mr. J. Casey spoke to the engineers, will probably have physical geographical as well as economic geographical results, if it is built. Sir Richard Temple's plan for a uniform scientific record of the languages of savages should interest all travellers; Mr. Edgar Thurston's account of the ethnographic survey of Madras all historical geographers; and Mr. Edmond Demolins' social classification those who study problems of social geography. These were communicated to Section H. In the Botanical section the stimulus which came in part from the geographers towards the study of ecological problems is producing excellent results, as the papers by Prof. Tansley, Dr. W. G. Smith, and Messrs. Lewis and Woodhead show. This section was fortunate enough to have a paper by Prof. Engler, of Berlin, on "Plants of the North Temperate Zone in their transition to the high mountains of tropical Africa."

The most important communication outside the Geographical section which had a geographical interest was probably the address given by Sir John Eliot, as President of the sub-section of Astronomy and Cosmical Physics, in which he dealt with the climatology of India—an address too full of important points to be summarized in the present report.

A NEW MAP OF TRANSBAIKALIA.

By Prince P. KROPOTKIN.

The just-published twenty-fifth part of the 'Geological and Mining Explorations along the Line of the Siberian Railway' (St. Petersburg, 1904, 4to, pp. 46), which is edited by the Russian Geological Committee, contains a new map of Southern Transbaikalia, in two and a half sheets, on the scale of 1 : 840,000, *i.e.* 13¼ miles to the inch. The map has been made, under the supervision of Prof. V. A. Obrucheff and his assistants, A. P. Gerasimoff and Prince Hedroitz, by Y. M. Barannikoff; the General Staff of Eastern Siberia and the Mining Administration, as also the head of the Baikal Hydrographical Survey, graciously supplying all the surveys and cartographic materials which they had in their possession. An explanatory text, containing the list of all the spots for which there were astronomical observations of latitudes and longitudes, as also a map showing the character of the different surveys which were available for the different portions of the region, are given by A. P. Gerasimoff with his text.

A mere glance at the map shows how much it is in advance of all previous work of the kind. The material has been most conscientiously and ably utilized, and for most of the region the river-network may be taken as quite reliable. There are, of course, large spaces, even in Southern Transbaikalia, which remain still imperfectly mapped, and are very poorly known as regards their orography; but immense progress is already realized by this new map.

Great attention has also been paid to the orography of the region. "As regards the situation and the directions of the mountain ranges," M. Gerasimoff writes, "the present map widely differs from the maps which are now in circulation, because under the name of ranges we did not understand disorderly running water-partings traced between the rivers, but such upheavals as are in strict causal dependence upon the general geological structure of the country and the direction of the tectonic lines, which are very often decisive in the determination of the present forms of the relief of Transbaikalia. In most cases those water-partings which, owing to their relative or their absolute altitudes, or to some other characteristic features, have received separate names from the local population, are nothing but portions, or even spurs of the tectonic ranges. Consequently, it was necessary to trace a number of ranges which do not exist on previous maps. To such orographic units new names were given (Cherski's, Erman's, Argunski range, etc.), or local names were extended to them (Zaganski, Tsagandaban, Borshovochnyi, etc.).

"If we consider the directions of the ranges of mountains, the now-published map will here also, in some of its portions, stand in distinct contradiction with existing representations. To give one instance, and not to encumber this sketch with too many such instances, I shall only point to the Yablonovoi Khrebet, which is usually represented as a water-parting between the tributaries of the Arctic and the Pacific ocean, and consequently is traced along the water-parting between the Ingoda and the Chikoi, the Ingoda and the Khilok, the Chita and the Konda; and between the basins of the Ingoda and Shilka on the one side, and that of the Lena on the other, although the tectonic lines which have determined its differentiation have quite another direction, and only for a short distance coincide with the Yablonovoi range of the old maps. What we call the Yablonovoi range is the water-parting between the Chikoi and the Khilok (the Malkhanski range), the Khilok and the Ingoda, the Chita and the Konda, the Karenga and the Vitim; it runs further on in a north-eastern direction into still unexplored regions. Another instance is the Adun-chalon, which is usually drawn as a long range running east-north-east; in reality it is a quite small massif, surrounded on all sides by wide lowlands" [high plains?—that is, plains of about 2000 feet in altitude—P. K.].

These few lines already give an idea of the importance of the new map. I will only permit myself one remark. I am delighted, of course, to see that the ideas which I expressed thirty years ago concerning the Yablonovoi range being continued in a due north-eastern direction, from the spot where it is crossed by the high-road to Chita, and not going to join the imaginary Stanovoi range,* are confirmed now by such high authorities as Gerasimoff and Obrucheff, of whom the latter has not only perfectly well studied all the previous explorations of Transbaikalia, but has also personally visited that portion of the Vitim and the Karenga. But I may be permitted to ask whether the map is right in considering the Malkhanski range, between the Khilok and the Chikoi, as a continuation of the Yablonovoi? This last, between the upper Khilok and the Ingoda, where we know it best, represents quite distinctly the south-eastern border-range of the upper terrace of the plateau. Now, my idea was, and is still even more than before, that a border-range having the same orographic character is continued south-westwards, through the Sokhondo, between the sources of the Menzia, right-bank tributary of the Chikoi, and the Balja, left-bank affluent of the Onon (cf. altitudes of Fuss), to the Kentei and the Burulyn-daba, to the south-east of Urga, where we again find an escarpment, quite homological with the one which we cross on approaching the town of Chita from the west. If this supposition be correct, then all the upper course of the Chikoi, from its sources to its bend at the mouth of the Jerghei, must lie *on the upper terrace of the plateau*, and therefore must be 1000 feet higher than the tributaries of the Onon, such as the Kyra river at the Kyrinski post, or the Kirkun river at Kirkunski. On the contrary, if this supposition be incorrect, then there must be no general difference between the altitudes of the region situated between the sources of the Khilók and its middle course (the *upper* terrace, in my view) and the valley of the upper Onon, which, by my supposition, flows on the *lower* terrace of the plateau. Further exploration of this region will therefore be most welcome, but we can already say that what we know about it from the altitudes of Fuss seems rather clearly to support the just-expressed view.*

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* See The Orography of Asia, in *Geographical Journal*, February, 1904, pp. 197–199, and with more detail in 'Orographie de la Sibérie, précédée d'une introduction et d'un aperçu sur l'orographie de l'Asie,' published by the Geographical Institute of Brussels, 1904, pp. 77–86.

The observations of Fuss reveal the existence of an escarpment, homological, on the one side, with the Kentei escarpment, and on the other with the Yablonovoi escarpment which faces the town of Chita. Is this merely an accidental homology, which surely must be shown on a map, but has no geological reason; or have we not here one more instance of the fact indicated by Gerasimoff in the above quotation—namely, that the orography of Transbaikalia is closely connected with the tectonic features?

Another remark which I will venture to make concerns the lower course of both the Argun and the Shilka. This part of the map is not yet finished, and the corresponding half-sheet seems to be but a temporary sketch; but we see on it, in long. 122° E., the inscription, placed in a direction from north-west to south-east, "Great Khingan Range." It is for the first time that the Great Khingan is placed in this position and in this portion of the territory, and no doubt the compilers of the map must have had some reasons for giving this quite new position to the great range. That there may be a range running north-west to south-east, and crossing the Argun and the Shilka, we certainly shall have no reason to question, if the geologists who have explored Transbaikalia do come to such a conclusion; but that this range should be *a continuation of the Great Khingan, i.e.* of the border range of the lower terrace of the plateau, which we know perfectly well from Kalgan to the sources of the Gan, where I crossed it in 1864, seems now to be extremely doubtful, not to say quite impossible. In order to admit that the eastern border-range of the upper terrace of the plateau makes this bend, we should require to find to the north-east of this new Khingan the lower Manchurian terrace of the plateau, while we know perfectly well from Usoltseff and Orloff that on the Oldoi we have a continuation of the *upper terrace of the plateau, i.e.* marshy plains over 3000 feet high. At any rate, in order to give such a new position to the Great Khingan, we ought to have at least some surveys between the upper

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* This is how I summed up the observations of Fuss: "The series of altitudes determined by Fuss gives a very neat idea of this escarpment. Leaving aside the observations made at the bottom of the valley of the Chikoi, which is pretty deeply sunk in the plateau, after having run a long course over its surface, we see that at the sources of the Katantsa the plateau reaches altitudes of 2900 feet; further on, the road, which goes eastwards, attains the altitude of 3500 feet, as it follows the Menzia; then it reaches the height of the pass across the Yablonovoi, and descends into a longitudinal valley; further on it crosses a range of mountains which runs parallel to the above escarpment, and reaches a height of 4500 feet—similarly to the range which runs on the left bank of the Chita and the right bank of the Ingoda [Gerasimoff has named it the Cherski range]; and, finally, the road issues on the lower, steppe-terrace of the plateau, where altitudes of 3000 feet are met no more on its surface, but where we find a steppe of from 2000 to 2500 feet of average altitude" ("General Sketch of the Orography of Eastern Siberia," in *Zapiski* (Memoirs) of Russian Geogr. Soc., 1875, vol. v. p. 48; 'Orographie de la Sibérie,' Brussels, 1904, p. 79).

Gan, where I crossed it (the most northern place where the Great Khingan has hitherto been crossed), and the place where we find the Great Khingan now on the map of Transbaikalia. Have such surveys been made? Or, is this simply a new local name which lately began to be given to these mountains (it did not exist in 1865, when I crossed this region), just as since the last Boxer war the name of "Little Khingan" has been given to the mountains which were formerly known as the Ilkhuri-alin? As this part of Gerasimoff's map of Transbaikalia is only provisional (the mountains are not yet traced on it, and the above inscription stands on a white space), we are sure that MM. Gerasimoff and Obrucheff will take these remarks of a fellow-worker in good part, and perhaps, by insisting upon the necessity of sending an expedition to the northern parts of the Great Khingan, will settle at last the exact position of this extremely important landmark.

THE ANNUAL RAINFALL OF THE BRITISH ISLES.*

DR. MILL has made another valuable contribution to the geography of the British Isles in this new paper. The rainfall of our islands has been discussed by Dr. Buchan and the late Mr. Symons among others, and recently Dr. Buchan prepared new maps for the months and the year based on twenty-five years' means, which were published in Bartholomew's 'Atlas of Meteorology.' Dr. Mill's data are not merely for a longer period, but they are discussed and mapped in much greater detail than has been done in previous papers on our rainfall.

Dr. Mill takes up, first of all, the question of the length of time rainfall observations must have been taken before means of sufficient stability are obtained to make the tables and the maps based on them thoroughly satisfactory representations of this element of climate. Dr. Hann has recently shown for Padua, Klagenfurt, and Milan that a thirty years' mean differs only about 2·6 per cent. from one three to six times as long, and a forty years' mean still varies 2·3 per cent., but a twenty years' mean differs 5·2 per cent. from the longer one. Dr. Mill finds that, for five British stations, the successive means for the thirty years beginning 1830, 1840, 1850, 1860, and 1870 are 98·6, 98·4, 100·3, 103·1, and 101·3 per cent. of the 70 years' mean. Hence the thirty years' mean 1870–99 may be taken to give a very close approximation to the true mean, and this he adopts as the basis of his work.

It is unnecessary to detail the checks applied to the returns to ensure their accuracy; suffice it to say that Dr. Mill has presented in tabular and cartographic form the most reliable and complete account of the rainfall of the British Isles yet published. The maps, as is proper in such a work as this, show only such results as can be deduced from the figures themselves, and it lies with the geographer, should he require it, to construct a map which will take into account the variations introduced by configuration and exposure. As it is, Dr. Mill's maps can be interpreted largely by configuration and wind maps without any question of personal bias entering into the estimation of the significance of configuration or air-movements on the distribution of rainfall as shown on the map. His map of annual rainfall agrees in the main with those already published. It is unnecessary to recapitulate the main characteristics of these maps. In many details, however, the new map reveals interesting features not previously shown. Among them may be cited the areas of greater precipitation over the Weald, the Downs, and the East Anglian Heights, which have never been so clearly brought out before. We need more rain-gauges close together where the elevation rapidly alters, and new and interesting results might be expected even from the districts just mentioned. In the Highlands of Scotland and in parts of Ireland there is a deplorable absence of rainfall observations, where it is most necessary to have many, not merely for scientific interest, but for their practical value in view of the rapidly extending use of water-power as a generator of electricity.*

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* "On the Distribution of Mean and Extreme Annual Rainfall over the British Isles," by Hugh Robert Mill, D.SC., LL.D., with an abstract of the discussion upon the paper. *Minutes of Proc. of Inst. of C.E.*, clv. pp. 3–88.

Dr. Mill points out that the existing figures do not permit the calculation of any generally applicable formula for the relation between the amount of rainfall and height.

The following table summarizes the results of Dr. Mill's calculations as to the areas of different amounts of rainfall, and the average rainfall and volume for the different parts of the British Isles:—

Area in Square Miles and Percentage of Total Area in Rainfall Zones.
Average of Years 1870–99.

	Under 25 inches.		25 to 30 inches.		30 to 40 inches.		40 to 60 inches.		Over 60 inches.	
	Area.	%	Area.	%	Area.	%	Area.	%	Area.	%
England ...	9776	19·5	18,552	37·1	15,333	30·7	5624	11·2	768	1·4
Wales	0	0·0	128	1·7	1856	25·2	3888	52·7	1504	20·4
Scotland ...	224	0·8	2368	8·6	9856	36·0	10,005	36·5	4960	18·1
Ireland ...	0	0·0	704	1·9	13,100	40·1	17,408	53·3	1482	4·6
Isle of Man ...	0	0·0	64	28·5	104	46·5	56	25·0	0	0·0
Total ...	10,000	8·5	21,816	18·5	40,249	34·3	36,981	31·4	8714	7·4

A valuable part of the paper is the discussion of the year of maximum and minimum precipitation, and the amount and the proportion of each to the mean. 1872 was the wettest year in the British Isles, and, as Mr. Tripp has pointed out, one of the wettest years on record for most parts of the world. 1887 was the driest. "Perhaps 1852 was as wet as 1872, and 1864 may have been as dry as 1887; but with these possible exceptions, no other year approached either as an extreme." The table on p. 468 shows the values for the average and extreme years.

The maximum and minimum rainfalls, however, are not synchronous for all parts of the British Isles, and it is not surprising to find that there is a marked climatic contrast between the west and east of Scotland, and, as Dr. Buchan has shown, the maximum on the one side may coincide with the minimum on the other. Mr. Archibald pointed out that eight places in the east of England had their minimum year 1874, and ten in 1898; while for six places in north-west

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* Of course such observations should be carried out by Government aid, and it is necessary to point out that a systematic study of this country's resources is one of the most pressing problems for our statesmen to consider. The ridiculous pittance at present available for meteorological purposes is only one of the many advertisements of our existing inefficiency. It is reported the Government even means to permit the closing of the only permanent observing station we possess in the upper air, instead of immediately setting up another in Kerry, as they should do!

Scotland 1874, and for four places 1898, was a maximum year. Dr. Mill points out that the extraordinary relative dryness of the east of England is greatly intensified in wet years. The maps show that the same influences of configuration and prevailing winds are at work in the wettest and driest years as well as in the average, and they also show "how prominent geographical influences really are, and how important it is to be able to understand fully the relationship between rainfall and configuration." These apparent anomalies of wet east with relatively dry west are to be explained by relative increase of rain-bearing easterly winds.

MAXIMUM AND MINIMUM RAINFALL.

	Quantities to nearest half-inch.					Ratios.				
	Average	Max.	1872.	Min.	1887.	Average	Max.	1872.	Min.	1887.
England ...	31·5	46·0	45·0	22·0	23·5	100	146	143	70	74
Wales	49·5	72·5	74·0	37·0	36·5	100	147	149	75	74
Scotland ...	47·0	69·0	62·5	34·0	39·5	100	147	133	72	84
Ireland ...	42·5	56·5	52·0	29·5	32·0	100	133	124	69	76
British Isles	39·5	56·5	53·0	28·0	30·5	100	143	134	71	77

We trust Dr. Mill will continue his investigations, and give us seasonal tables and maps, which will attempt to show the climatic as well as the astronomical seasonal changes, and will be applicable to the study of the climatology of wheat and other crops.

A. J. H.

REVIEWS.

EUROPE.

THE FÆRÖES.

'Botany of the Færöes based upon Danish Investigations.' Copenhagen: det Nordiske Forlag; and London: John Wheldon & Co. Large 8vo. Part i. (1901), pp. 1–338; part ii. (1903), pp. 339-681. *Map. Plates and Figures.*

AFTER some introductory remarks by Warming on the history of botanical investigations in the Færöes, the various conditions—geographical, topographical, geological, meteorological, and industrial—are reviewed by Ostenfeldt in the first volume.

The Færöes are a small group of eighteen islands, with a population numbering 15,000 people, of whom most are descendants of Norsemen, but a few are of Irish descent. Grass is grown for the horses, cattle, and sheep; corn and potatoes for human consumption. The inhabitants also go in for fishing and whaling.

The rocky island scenery is characterized by precipitous and terraced faces, which harbour but few plants. The lower districts are less sloping, and the rocky *débris* found here is covered by grass. The various islands are separated by sounds, which are submerged long valleys, and they are characterized by irregular outlines, owing to the fjords, which represent submerged cirque valleys. Many small streams and lakes are met with.

The rocks belong to the Tertiary formations, and are of igneous origin. Basalt with layers of tuff intercalated alone occurs in large quantities. Coal is found, and also mined. The action of the Ice age can be clearly made out.

The climate is what we would expect to find in an archipelago. The winter is mild, the summer cold; there is a heavy annual rainfall; storms and fogs are of frequent occurrence.

Of the Phanerogams and Vascular Cryptogams no representatives have been found to be endemic in the Færöes, having all been recorded from the neighbouring countries, seven species only not occurring in Great Britain. Although trees are absent, the flora is of a type characteristic of a woody district in temperate Europe, being most like that met with in Northern Great Britain. Ostenfeldt proves at some length the post-Glacial age of the flora. The plants migrated across a post-Glacial belt of land, and were not brought to the island by birds, wind, or man.

The remaining portion of the first volume is devoted to lists of plants recorded from the Færöes. These are continued in the second volume, which in its turn is concluded by a detailed account of the history of the flora of the Færöes. The third volume will contain a description of the vegetation of the island as an organic whole. O. V. D.

ASIA.

HISTORY OF ARABIAN EXPLORATION.

The Penetration of Arabia: A Record of the Development of Western Knowledge concerning the Arabian Peninsula.' By David G. Hogarth. Lawrence & Bullen. 1904. Pp. xvi. + 360. *Illustrations and Maps.*

This second volume of the "Story of Exploration" fully maintains the promise held out by Sir Harry Johnston's 'Nile Quest,' with which the series was opened. Although not himself an Arabian traveller, the established reputation of the author for sound scholarship, and especially for an extensive knowledge of the history, geography, and archæology of the Near Eastern lands generally, was sufficient guarantee that he would give us a valuable book on the progress of geographical research in the Arabian peninsula. A critical study of the rich though not very accessible literature of the subject has enabled him to present a clear and nearly complete picture of exploration in this at once attractive and repellent region from early times down to the present day.

For convenience of treatment, the subject-matter is disposed in two main divisions, the first dealing with "The Pioneers," the second with their "Successors," the whole concluding with a lucid and very welcome summary of the salient physical features of the land. In the introductory chapter, "Before Exploration," there is also a good deal of geographical detail, and here occurs the statement that, "despite Ptolemy, Arabia has not, and probably never had, a true river in all its immense area." This, no doubt, is practically true for the historic period which, in the light of the recently discovered Himyaritic inscriptions, must now be set back to at least the third millennium B.C. But it is difficult to believe that in more remote times the Wady er-Rumma and the other now nearly dried-up arteries were not great perennial watercourses like the corresponding Igharghar, Masarawa, and many others in the Sahara.

But, if here criticized, Ptolemy is elsewhere amply vindicated from the aspersions of Bunbury, who charged him with filling empty spaces with fictitious names "assigned with a vain parade of science to imaginary situations." Many of these names have since been identified, and *Thaim*, the *Tema* of Job, is now known from Assyrian documents to have had a very real existence in Minæan times (A. Jeremias, 'Das Alte Testament' (1904), p. 232).

Conspicuous amongst the later "Pioneers" is the name of Carsten Niebuhr, whose signal services, both as an explorer and archæologist, receive the fullest recognition. As is here pointed out, the primacy always conceded to the Danish traveller is not due to his priority in time, for he was preceded by others (Varthema, Hamilton, Barbier); nor to the extent of his surveys, which were confined to a very narrow corner of the peninsula; but entirely "to the priority of his merit." So accurate are his descriptions, that Playfair is quoted as stating that, after a lapse of over a century, "we have never since been given a clearer or more interesting and valuable account of Yemen." This term *Yemen* is usually taken as synonymous with Pliny's *Arabia Felix*, which is wrongly restricted to south-west Arabia. "*Felix* was really applied by the ancients to the whole of the peninsula. *Petræa* was only the district of Petra, and *Deserta* the North Hamad or 'Syrian Desert'" (p. 41). It is, however, to be noted that if, instead of *yemen* = south, we are to read *yaman* = happy, this expression would then appear to be equivalent to *Arabia Felix* in its more restricted sense, and the general aspect of the country certainly lends colour to this now current use of the term.

In the pioneer section the scene shifts from Yemen to the northern territory of Hejaz and Nejd, then to the south-west and south, and so back to the "unknown north." Here the reader will be able to follow the steady progress of the first rough surveys of the greater part of the interior and coast lands in company with such skilful guides as the erudite Burckhardt, the keen-eyed Seetzen, the accurate Wellsted and Wallin, and the ubiquitous Burton. All receive ample justice at the hands of our most conscientious author, who carefully traces their often intricate itineraries with unwearied patience. The monotony of this necessary work is continuously relieved by graphic accounts of Wahhabis and Shommars, of desert life, and of renegades and adventures, such as Keith, the Scot, governor of the Holy City of Medina in 1815, Atkins the Englishman, and the Italian Finati, both careering up and down the peninsula during the Egyptian campaigns.

The rest of the volume, about one-half, is given up to the "Successors" of the pioneers, "the second generation of Arabian explorers," whose operations begin with the middle of the nineteenth century, and are still far from concluded.

Here the regions revisited and more fully explored are the western, southern, and eastern borderland, the central north, the centre, and the central south, all in the order named. Amongst the names which now begin to crowd the author's pages, the more prominent are J. Halévy, Glaser, Bent, Manzoni, Palgrave, Pelly, Huber, Euting, and the never-to-be-forgotten C. M. Doughty. All receive due recognition with the rather important exception of the late Theodore Bent, whose fruitful researches amid the extensive ruins that I have been able to identify as those of the Biblical Ophir have been strangely overlooked.

The publishers deserve all praise for the way they have turned out this handsome volume, with its stout paper, bold type, copious index, plans, maps, ancient and modern, and excellently reproduced portraits of Niebuhr, Burton, Seetzen, Burckhardt, Halevy, Palgrave, Doughty, and some other Arabian worthies.

A. H. KEANE.

AFRICA.

MAJOR GIBBONS ON HIS AFRICAN JOURNEYS.

'Africa from South to North through Marotseland.' By Major A. St. H. Gibbons. 2 vols. London and New York: John Lane. 1904.

For the extent of his routes through unknown or imperfectly known African countries, Major Gibbons stands well in the front rank of recent travellers in that continent. While from some points of view his journey of 1898–1900 may be considered as among the last of the great pioneer journeys, it belongs also to the new order of things in regard to the detailed character of the work accomplished in its special field of activity—the Zambezi basin. The full narrative of the events of the expedition, which has now appeared after an interval of some five years since its author's return, could not fail therefore to supply material of the first importance to the student of African geography and ethnology, and this expectation is in no way disappointed on a closer examination of the volumes.

The general outline of Major Gibbons's work is well-known to readers of the *Journal* through the paper read before the Society after his return from Africa, and it is needless to enlarge upon it here. The subject-matter of the book may be divided into three main sections, the first dealing with the examination of the middle and lower course of the Zambezi—the first ever undertaken with sufficient thoroughness to give an accurate idea of the possibilities of navigation on the great river; the second describing the journeys by various members of the party, which threw a network of routes over the whole extent of the Marotse empire; and the third embracing the homeward route across the Congo basin to the Nile. The first two of these sections form, perhaps, the most solid and valuable part of the book, which, it can hardly be questioned, is the most important contribution to our knowledge of the Zambezi basin which has appeared since Livingstone's time. The memories of the great explorer which it calls up from time to time will give it an added interest to many readers.

In the first section the attention of the reader is naturally focussed on the gallant efforts put forth by the explorers in their struggle with the furious current of the Zambezi during its passage through the gorges which characterize its middle course, the sombre impressiveness of which is vividly depicted by the author. It was only by almost superhuman efforts that the *Constance* was successfully brought through some of these, and that disaster was avoided speaks well for the qualities of the vessel, constructed on the Hodgetts principle. The state of the river when the ascent was made rendered the test of its navigability a particularly severe one, and in spite of the difficulties encountered, Major Gibbons considers the result to be on the whole distinctly favourable to the use of the middle and lower sections of the river as a waterway.

The second and largest section of the book supplies, incidentally, many details regarding the physical character of the upper Zambezi region, both on the east and west of the main stream. On p. 116 (vol. i.), the author sketches the general aspect of this upper basin of the river, which is marked above all by its white sandy soil, rising between the rivers into a succession of undulations. On the Okavango, on the other hand, a yellow soil prevails, and with it a vegetation marked by thorny acacias. The information as to the course and character of this river—hitherto inaccurately placed on our maps—is of much value. Further north, Major Gibbons entered the area of the dwarf *Landolphia* (*L. florida*), which forms the basis of the rubber industry of this part of Africa. In this region too he met with a yew-like tree, which took a prominent place in the vegetation, though not seen at all further east. But perhaps the most interesting chapters are those dealing with the Marotse and their history, and their relation to their king, Lewanika, of whose qualities as a man and ruler the author entertains a high opinion. He points out the unmistakable distinction existing between these people and the rest of the natives of South Africa, and hints at a possible connection between them and the dwellers around the northern lakes. Information is also given as regards the various other tribes included under Lewanika's far-reaching sway. The Marotse state differs from the ordinary Negro kingdom in possessing a recognized constitution, while the royal family and upper classes have shown an adaptability to civilized ideas which the author ascribes to "the elements of refinement and self-respect which exists even in a barbarian aristocracy."

The final section of the journey was noteworthy, as leading to the ultimate source of the Zambezi, which Major Gibbons was the first to describe. The further route along the Zambezi-Congo water-parting would have been of even more importance but for the fact that the Belgian expedition under Capt. Lemaire had simultaneously chosen this line of country as a field of work. The part of the journey carried out in company with Capt. Lemaire gave, however, a useful opportunity of checking the results of the survey, and Major Gibbons dwells with pardonable satisfaction on the close agreement of his work, done with the humble and often-criticized sextant, with that accomplished by the more elaborate methods of the Belgian officer. Another direction in which his ideas met with full justification, was that of the proper conduct of an exploring expedition in its relation to the natives, his experiences supplying yet another proof of the ease with which an unarmed expedition can, as a rule, make its way among new tribes, and the demoralization often caused by the use of armed askaris. Major Gibbons enters somewhat fully into the question of the height of the Ruwenzori range, which, like Sir H. Johnston, he thinks must reach 20,000 feet.

Major Gibbons shows himself throughout a careful observer, anxious to understand the peoples with whom he is brought in contact, and capable of giving the results of his observations in generalized form. The high ideals which he set before him as to the part to be played by white men in their contact with the black race, enabled him to fully sustain the high reputation enjoyed by British travellers in the past, and his remarks, both in the body of the work and in the appendices, on the missionary question, the mental and moral qualities of the Negro, and the right methods of raising him in the scale of civilization, merit careful attention.

The work is illustrated by excellent maps prepared by the author himself, that of the middle and upper Zambezi basin, on a somewhat larger scale than Mr. Ravenstein's map in the *Journal* for February, 1901, being the most valuable.

AMERICA.

DUTCH GUIANA.

'Gegevens over Land en Volk van Suriname.' Door C. Van Coll, Missionaris in West-Indië. (Bijdragen tot de Taal-, Land-, en Volkenkunde van Nederlandsch-Indië. Deel i. Afl. 4.)

These notices appeared a few years ago in the supplements to the newspaper *De Suriname*, and are now reprinted in an enlarged and amended form. Pater van Coll has availed himself of the works of Kappler, Crevaux, Im Thurn, and other authors, to whom he acknowledges his indebtedness, but having passed more than thirty years of his life as a missionary in Dutch Guiana, he has collected much information himself on the manners and customs of the coloured inhabitants. In the first part of his work he describes the aboriginal tribes—the Caribs, Arrowaks, and Waraus. After a short sketch of their history and their relations with the white settlers, he passes on to their villages, clothing, food, and utensils, their feasts and marriage customs, their religious beliefs and myths. The second part contains an equally full account of the Bush Negroes, the difficulties they had to contend with in supporting life in the forest after they had run away from their white masters, and their superstitions. A rich store of facts is collected in these pages which the ethnologist will find useful. The author himself makes little attempt to discriminate between what is of purely native origin and what has been learned from Europeans. For instance, some of the legends he retails as of Indian origin seem to have a decided European tinge. The third part of the work is of less value, being almost entirely a compilation, in which, moreover, the works of recent travellers have not been utilized; it deals with the whole Guiana country and the surrounding peoples.

THE MISSIONARY IN THE CHACO.

'Among the Indians of the Paraguayan Chaco.' Edited by Getrude Wilson, B. LITT. C. Murray & Co., and South American Missionary Society. 1904. Pp. xiv., 176. With a Map.

Mr. W. Barbrooke Grubb and his fellow-workers in the Chaco Mission have provided material for this excellent account of the Indians of that little-known region about the Tropic of Capricorn and west of the river Paraguay. The account, it is true, is merely incidental to the history of the mission up to the present day; but it is well illustrated with many photographs and an engraving. The missionaries do not appear to have any inclination towards topographical description; if they had, the map inserted in the volume could hardly have passed. This shows a large area of central South America, which has no bearing on the subject, except as including the small particular area covered by the mission; and there is a large-scale inset of that particular area. The two representations of the mission area are hardly recognizable as the same country. It is well to be able to record that the Chaco missionaries, aided from without by their successive superintendents, Bishops Stirling and Every, of the Falkland islands, have met with deserved success in their difficult task.

O. J. R. H.

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

PRIMITIVE TRADE.

'The Silent Trade: A Contribution to the Early History of Human Intercourse.' By P. J. Hamilton Grierson. Edinburgh: Green & Sons. 1903. Pp. x. + 112.

By the "Silent Trade," Mr. Grierson means what the Germans call the "Stummer Handel," that kind of barter that sprang up between primitive peoples before they were, so to say, on speaking terms with each other, while, in fact, the normal attitude was still one of mutual distrust and hostility. References to the subject are very numerous, and range over the whole of literature from classic times (Herodotus, Pliny) down to the last book of modern travel. But they are for the most part of a casual or incidental nature, and Mr. Grierson may rightly claim that in this little volume, a veritable *multum in parvo*, the traffic has for the first time been subjected to systematic treatment. He has not only shown great learning and diligence in bringing together a vast number of passages bearing on the practice from almost every available source, but has also formulated a reasonable theory of its origin and evolution, a theory all the more acceptable since it is not deduced from any preconceived notions, but is a legitimate induction from a careful study of many facts vouched for by the most trustworthy observers. As the *homo homini lupus* stage gets worked out, it dawns upon the primitive hunter that the stranger may be more profitable living than dead. He possesses covetable belongings which may be more easily or more safely obtained by peaceful means than by open violence; and as one good turn deserves another, something tempting is placed within his reach on the tribal borderland, in the hope that it will be accepted as a "gift," which in rude society always expects a *quid pro quo*. If the bait takes, the manœuvre is repeated, the practice spreads, and all the rest follows in natural sequence. Trysting-places become intertribal markets; the clever interpreter who knows both languages becomes the recognized middleman; and everything gradually receives social and religious sanction. Hence the Greek *Hermes Agoraios*, the Gaulish Mercury, the sacred character of the herald, of the envoy, the ambassador of later times. It is thus seen what an important part the Silent Trade has played in promoting international intercourse, and furthering social progress in all directions.

A. H. K.

AUSTRALASIA AND PACIFIC ISLANDS.

Australian Ethnology.

'The Northern Tribes of Central Australia.' By Baldwin Spencer, M.A., F.R.S., and F. J. Gillen. London: Macmillan & Co. Pp. xxxv., 773. 315 *Figures, Two Illustrations, and a Map.*

Five years ago Prof. Baldwin Spencer and Mr. F. J. Gillen published a very remarkable book, 'The Native Tribes of Central Australia,' that gave new and unexpected information about the aborigines of Central Australia, and the new ethnological problems suggested by their researches led to lively discussions which have not yet subsided. In their recent traverse across Australia, these authors restudied the tribes they had previously visited in order to check the observations that had been so much discussed, and to extend their investigations to other tribes. This they successfully accomplished, and we now have a reasonably complete account of the native tribes from Lake Eyre to the Gulf of Carpentaria, and the new researches of these indefatigable travellers connect up those of Dr. A. W. Howitt in the south with those of Dr. Walter Roth in the north. They also confirmed and extended the accounts they had previously given, so that what formerly appeared to be anomalous in the ethnology of Australia has been shown to be fairly widely spread, and, indeed, may have been very general. Negative evidence counts for very little in ethnology, as usually that which is most important and most worth learning about is the very information that is most zealously hidden from the stranger.

Messrs. Spencer and Gillen have proved that the magical ceremonies for the increase of totemic animals, which they first discovered among the Arunta, have a wide range, and incidentally they illustrate what a close connection exists between the religion of a people and the physical conditions under which they live.

The time has not yet arrived when it is possible to map out the distribution of certain customs or implements all over the continent of Australia, but this new book gives a considerable number of facts which will go a long way towards this end, and the authors constantly bear distributional problems in view.

This book must be regarded as one of the most important records ever published of a backward people; the accounts of secret sacred ceremonies are given with great detail, in clear language, and illustrated by a large number of most remarkable photographs.

A. C. H.

THE MONTHLY RECORD.

EUROPE.

The Wettest Place in Wales.—In the August number of *Symons's Meteorological Magazine*, Mr. J. R. Gethin-Jones gives the results of measurements of rainfall made by him in the heart of Snowdonia, at a spot which he considers likely to prove the wettest in the Snowdon range, and consequently in all Wales. His choice of a spot for the setting up a gauge in 1898 was determined by considerations arising from the configuration of the surface, the Cwm Llydaw, in which the spot lies, being bounded by ridges over 3000 feet in average height, and taking the form of a horse-shoe open to the east or the driest quarter. The effect of this configuration is that, in case of all the wettest winds (from S. by W. to N.), the Cwm forms the sheltered focus in which the moisture-laden currents experience the maximum effects of condensation after passing the ridges. Apart from this special point in favour of Cwm Llydaw, the position of Snowdon itself is particularly conducive to excessive rainfall, inasmuch as five separate valleys radiate from its base towards the sea and the wettest points, and along them the lower strata of the air are conveyed under the most favourable conditions for retaining moisture, and then suddenly lifted 3000 feet within a small horizontal distance. The observations at the Glaslyn gauge in this cwm, from September 1, 1898, to December 31, 1901, give an average annual rainfall of 199·92 inches, which would probably be reduced to about 190 inches over a longer period, judging from observed data at neighbouring stations. During 1903, in which, unfortunately, the record is available for seven months only, Mr. Gethin-Jones concludes, from comparison with the fall at other stations, that the total must have been at least 250 inches, which would exceed the highest yet recorded (243·98 inches at the Stye, Cumberland, in 1872). He urges that more accurate observations should be taken regarding the maximum rainfall in Scotland and Ireland, where, he thinks, figures far higher than any yet obtained would be forthcoming. From a consideration of the facts at the Stye and Snowdon, he thinks that in the sheltered corrie north of Ben Nevis a total of over 300 inches ought to be recorded.

The Coasts of Britanny.—Prof. E. de Martonne presents a review and a valuable supplement to Dr. F. Schwind's dissertation on rias and fiord coasts.* Dr. Schwind arrived at the following figures for rias coasts from his measurements of British and French Admiralty charts:—

Coast.	L = Length of coast. Km.	Proportion of Islands. Per cent.	l_1 = exterior contour. Km.	l_2 = interior contour. Km.	$\frac{L}{l_1}$	$\frac{L}{l_2}$	$\frac{1}{2}\left(\frac{L}{l_1}+\frac{L}{l_2}\right)$
Britanny	3475·571	19	517·610	572·850	6·71	6·07	6·39
Galicia	1902·578	20	341·659	339·735	5·56	5·60	5·58
Corsica	667·3	5	214·6	184·9	3·11	3·61	3·36

The Rennes professor properly points out that the Britanny results are vitiated by the inclusion of such islands as Croix and Belle-ile, situated 3 to 6 miles from the coast, and the assumption that all the coasts of Britanny are ria coasts. Using part of Richthofen's original definition, which is based on the relationship of the coastal form to the tectonic feature lines, only the west transverse coast should contain rias; but following Penck, Dr. de Martonne uses the other part of the definition of this form as one for an elongated gradually shallowing and gradually narrowing inlet independent of structure. Obviously such forms are equally confined to limited parts of the Breton coast, the heterogeneous nature of which is clear from the following table, where L, l_1, l_2 have the same meanings as above:—

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* "Die Riasküsten und ihr Verhältniss zu den Fjordküsten, unter besonderer Berücksichtigung der horizontalen Gliederung" (*Sitzber. Böhm. Ges. d. Wissensch.*, Prag. 1901. Dissertation, Leipzig, 1901). Mr. de Martonne's paper is in the new part of the *Travaux scientifiques de l'Université de Rennes* (vol. ii. pt. iii. 1903).

	L Km.	l_1 Km.	l_2 Km.	$\frac{L}{l_1}$	$\frac{L}{l_2}$	$\frac{1}{2}\left(\frac{L}{l_1}+\frac{L}{l_2}\right)$
North coast between Grouin and St. Mathieu	1275·908	257·35	254·35	4·94	5·01	4·97
West Coast between St. Mathieu and Penmarch	478·873	96·50	115·80	4·96	4·14	4·50
South coast between Penmarch and Lorient	508·494	71·00	92·75	7·16	5·47	6·31
South coast between Lorient and Croisic	1151·296	92·51	108·75	12·42	10·29	11·35

Dr. de Martonne analyzes the coast more carefully in relationship to the tectonic characteristics of the land, and arrives at the following divisions:—

Ia. Pure ria: (1) from Point de Grouin to Cape Fréhel; (2) from Point Plouzec to Point St. Mathieu; (3) from Point of Penmarch to Loctudy.

Ib. Sub-type of ria found in the bay of St. Brieuc.

Ic. Sub-type of ria in folded regions at right angles or obliquely inclined to the mean direction of the coast, here termed the anse type. From Point St. Mathieu to Point of Penmarch.

IIa. Aberrant type of ria in regions folded parallel to the mean direction of the coast (cf. the vallone of Dalmatia). From Concarneau to Port Louis.

IIb. Morbihan type, resulting from an elevation of, or deposition round coasts of type II*a*., with lagoons, sand-spits, and sandy soldering of adjacent islands (Quiberon peninsula). (1) From Loctudy to Concarneau; (2) from Port Louis to the Vilaine.

IIIa. The same type more advanced, from the Vilaine to the Loire (type guérandais). Here the islands and peninsulas are eliminated, and the lagoons dried up or almost desiccated (cf. Croisic salt-pans).

IIIb. Marsh type. Flat alluvial coasts of the marshes of Dol, which may be formed by the flooding of form III*a*.

In the north the ria predominates; in the west, the anse; in the south, the Morbihan or Dol types. It is necessary in all coastal studies to do more than measure; the first procedure should be to examine the structure of the land in its coastal margin.

Scientific Study of the Lake of Bolsena, Italy.—Some three years ago the Italian Geographical Society decided to undertake a thorough investigation of one of the Italian lakes, following in this way the example set by the Hungarian Geographical Society some years ago in the scientific examination of Lake Balaton. The choice fell on the Lake of Bolsena, which seemed to possess particular advantages in its accessibility from Rome, and in the interest arising from its size, depth, and the geology of its neighbourhood. The lake had already been investigated with some care from certain points of view, the morphology of the basin having in particular been thoroughly elucidated by the soundings carried out by Dr. G. de Agostini, while its hydrography had also been studied by Sig. E. Perrone. But many of its phenomena still remained to be investigated, particularly its temperature relations and the phenomena of the nature of seiches. A special commission, consisting of Signors Novarese, Sella, Vinciguerra, and Palazzo, was nominated to carry out the observations, the results of which are to be published in the form of an exhaustive monograph. They have now been in progress for two years, and a preliminary note on the methods employed and work accomplished was given by Prof. Palazzo in the *Bollettino* of the Italian Geographical Society for May, 1904. A base of operations was fixed upon in the town of Bolsena, where the use of certain rooms in a suitable building was obtained for the installation of the scientific instruments, etc. A complete series of observations on the air temperature, rainfall, and other meteorological elements is here carried out, while on the lake-shore a Sarasin limnograph and a gauge for recording the levels have been kept working. The former was fixed at the extremity of the jetty in the small harbour, a space being walled in, and the instrument protected as far as possible from the influence of the waves, communication with the lake outside being maintained by means of a pipe. The instrument is visited daily by Signor N. Mezzetti, of Bolsena, who also takes the level by the gauge, determines the temperature of the water, and notes the general conditions of the lake. A second station, somewhat less elaborately equipped, was established at the village of Marta on the opposite or southern shore. Here the houses touch the water, and some have basement chambers below the lake-level, so that a suitable location for the limnograph was easily found. The results obtained here were excellent, the records of seiches in the lake being unusually striking. Those due to longitudinal oscillations were particularly well marked, owing to the position of Marta almost at the southern end of the major axis of the lake, which has an elliptical form. Their period was about 14·75 minutes. It seems that the existence of these oscillations has long been known to the inhabitants, who say that they sometimes reach an amplitude of 30 cm. (almost a foot). The limnograph was constantly registering seiches of one sort or another, and regular series maintained for whole days were frequently obtained. At Bolsena the limnograph did not give such striking results; thus, while on July 21, 1903, a uninodal seich with an amplitude of over 17 cm. (6·7 inches) was recorded at Marta, the corresponding amplitude at Bolsena was only 9 cm. (3·6 inches). This is due to the greater distance of Bolsena from the end of the major axis of the lake, and the greater steepness of the shores at this part. The movements are also more complicated at Bolsena, and the existence of the oscillations had not previously been noticed there by the inhabitants. In addition to the main station at Bolsena, meteorological stations have been established at various points in the neighbourhood of the lake. Observations of the temperature of the water at the surface and at various depths have been taken regularly once a month, and were to be continued to the end of the second year. The colour and transparency of the water have also been observed. Prof. Palazzo hopes to give fuller details on all the observations in future articles.

The Platform of the High Summits of the Transylvanian Alps.—Mr. de Martonne has recently pointed out that the summits of the Transylvanian Alps do not possess the characteristics of high mountain peaks, although they rise to over 2400 metres. The undulatory plateau of Paringu is about 2000 metres (6600 feet), and further west the platform becomes more marked, and in the Boresco varies from 2050 to 2150 metres (6725 to 7050 feet) for several square kilometers. This can be traced into the Southern Retyezat, Tarco, and the *massif* of Godeanu, incised by narrow valleys to more than 1000 metres (3300 feet). The platform is continued in the Vulcan Mountains, and in those of Hermannstadt and Fogarash. This platform of Boresco, as he calls it, is thus a fundamental form in the Southern Karpathians. It nowhere coincides with the rock structure, but extends over crystalline and sedimentary rocks, and is an eroded surface with no deposits. It is a peneplain with an origin similar to that of the plateau of Mehedinti; and was formed in Palæozenic and early Neogenic times. The denudation of an elevated range explains the abundance of detritic sediments in the

Karpathian flysch. By the end of Miocene times, all traces of the old tectonic conditions had disappeared, except some valleys and heights of more resistant material. A Sarmatian elevation took place throughout the Transylvanian Alps, and is probably correlated with the folding of the flysch region, but was not accomplished without a tilting of the platform (Vulcan and Fogarash), and even its rupture at places. The cutting of gorges followed. Probably this was not the only elevation; for in certain valleys (of Vulcan) and interior sedimentary basins (Brezoin) there is an inferior platform—the valley platform. Hence, especially in the less resistant rocks, the post-Sarmatian erosion cycle enlarged the depressions and levelled part of the surface. This platform being carried to 700 and 800 metres (2300 and 2600 feet), a new movement took place, probably at the end of the Pliocene. The total rise in successive stages of this high plateau amounts to 1900 to 2000 metres, and is balanced by the sinking of the Hungarian and Valakhian (Wallachian) plains. The glaciation of the Southern Karpathians is partly due to this Pliocene elevation. Two types can be recognized, which may be used in classifying all the massifs of the High Karpathians: (1) the Boresco type, where the platform is the highest surface, and is notched by cirques as by giant quarries; (2) the Fogarash type, where the platform is dominated by the heights of the relic mountains (Monadnocks) of the Palæogenic erosion cycle, cut by glacial cirques, which give it a truly alpine appearance.—(*Comptes Rendus*, cxxxviii., 6 juin, 1904.)

Navigable Waterways of Belgium.—A recent Consular Report (Miscellaneous, No. 604) on the Navigable Waterways of Belgium, gives their mileage at 1360, or 1 mile of waterway to every 8⅓ square miles of area. Directly controlling 85 per cent. of them, the State has during the last twenty-five years spent £16,000,000 on ports and canals alone. In return for this outlay, the volume of canal traffic has vastly increased, and goods are now in many instances transportable in barges of 300 tons direct from factory to seaport without reshipment—a saving in transport both of raw material and finished article. Barges at the port of Antwerp have, in the twenty years 1882–1902, increased in number by 17 per cent., and in tonnage by 270 per cent., the increase in tonnage being due to the fact that waterways have been made available for barges of greater draught, by which a large reduction in transport rates has been effected. In 1902 the number of barges entering the port of Antwerp was 31,850, of a gross tonnage of 5,705,731, whereof 3,710,813 tons were concerned with purely Belgian traffic, the rest with merchandise from Holland, Germany, and France. In 1882 there entered 27,998 barges of 2,079,658 gross tonnage. The increase in the twenty years is derived chiefly from the foreign trade, which shows an increase of 143 per cent. in the number of barges, and 367 per cent. in the tonnage. The Rhine barges carry goods without transhipment all the year round—unless when prevented by ice—between Antwerp, Cologne, and Mannheim, and from April to October also supply communication with Strassburg. Among the canals the improvement of which is projected, the Campine canals (including the junction canal between the Meuse and Scheldt, the Maastricht-Bois-le-Duc and Liége-Maastricht canals), at present 6 feet 10 inches, will be increased to 8 feet 2 inches in depth, and their bed widened from 32½ feet to 76½ feet, thus allowing the passage of 1000-ton barges as against 350-ton barges at present. The route from Antwerp to Paris *viâ* Brussels and Charleroi is, owing to the inferior capacity of the Brussels-Charleroi canal, available only for barges of not over 70 tons. Works now in progress will, when completed, open this canal to 400-ton barges. The total cost of the improvements is estimated at £2,145,200, one-half of which has been already spent. The improvements now being undertaken in the Ghent-Terneuzen canal will, when finished, allow of the passage of far larger ships than at present. A new lock and a new outer port are to be constructed at Terneuzen. A new basin with five subsidiary wet docks is in course of construction at Ghent, while improvements are also being carried out at Bruges, Ostend, Brussels, and elsewhere.

Projected Railway from Turin to Martigny.—The *Tour du Monde* of June 11 last sketches this new railway project, which it considers likely to be put into execution before long. The line would have a total length of 157 kilometres (97½ English miles), with a maximum gradient of one in twenty, while the traction would be electric, power for this purpose being supplied by waterfalls. Breaking off from the line connecting Modane with Turin, the new line would cross the plains of the Canavese to Pont, entering the valley of the Orco, and passing by a tunnel under the Paradis *massif*; then, mounting halfway up the left flank of the Aosta valley, it would pass Morge and Courmayeur, whence, by tunnel under the Col de Ferret, it would run in Swiss territory along the Dranse to Martigny. The new line, it is pointed out, would have the advantage over the Mount Cenis, St. Gothard, and Simplon lines as the shortest route between North-Western Italy and the countries of Central Europe.

ASIA.

A Recent Journey in Mongolia.—The journeys of Mr. C. W. Campbell and Messrs. Russell and Hicks-Beach in Eastern Mongolia have been followed by one undertaken towards the end of last year by Mr. George J. Kidston, accompanied by Mr. A. J. Flaherty of His Majesty's Consular service, who went north from Peking, and beyond Dolon Nor followed a route to the west of Mr. Campbell's. Although the country had been previously visited by various travellers, the fact that few Englishmen have made themselves acquainted with this region gives a certain interest to the journey. An account of it has been printed in the form of a Parliamentary Report (China, Nos. 3 and 4, 1904), illustrated by photographs taken by the travellers, and by a map showing the general course of the route, compiled by Lieut.-Colonel Wingate of the Tien-tsin Intelligence Department. The route to Dolon Nor led at first north-east as far as Chengte or Jehol, instead of taking the more westerly direction *viâ* Kalgan followed by Mr. Campbell. Beyond the great wall the country becomes gradually poorer, crops becoming rarer and of poorer quality, while flocks and herds become more and more the main resource of the peasants. Most of the valleys are choked with masses of boulder, gravel, and sand, only a narrow band of cultivation intervening between this *débris* and the black rocks which bound the valleys. Dolon Nor, the chief trading centre of this region, sends to Tien-tsin considerable quantities of sheep and camel wool for shipment to England (and in the case of the former to Germany), salt being the next most important commodity. Beyond this the route led for 100 miles through a tract of sand-hills, and afterwards over the great grassy plain which rises gradually to the east to the great Khingan. Mr. Kidston seems to have been unprepared to find how little this had the character of a range when seen from the west, though its true character of somewhat broken escarpment of the plateau has long been realized by travellers in this region. The road across the plain was excellent, immensely wide, and usually as smooth as asphalt, so that apart from the occasional sand-hill belts, a bicycle or even a motor-car could be taken all the way to Khailar. The latter place formed the limit of the journey, for though the travellers had planned to go to Urga, the lateness of the season rendered this impracticable, the Gobi being deep in snow and quite impassable. As it was, intense cold was experienced before Khailar was reached (November 5), and the last part of the way was done through deep snow-drifts, through which only camels could pull the carts

The cold began with a change of wind to north-west on the evening of October 6, the minimum of that night being 3° Fahr., as compared with 42° the night before. Mr. Kidston's thermometer was broken after this, so no more readings were possible. During a furious blizzard refuge was taken at the camp of a Mongol prince, who rules over a very large district, and seems to have little felt the effect of Russian influence. Summing up his impressions of the country traversed, Mr. Kidston thinks it is doomed to continue much as at present, a waste spot inhabited only by wandering herdsmen. He saw no signs whatever of the construction of a railway such as was declared by Mr. Gerrare to have been begun from Khailar towards Kalgan, although the route crossed the supposed line at two separate points; and none of the inhabitants seemed aware that surveys even had been made. Besides, in Mr. Kidston's opinion, the sand-hill belt north of Dolon Nor would be an invincible obstacle, while water, wood, and stone are all equally wanting.

The Treaty with Tibet.—The negotiations which followed the successful entry of the British force into the Tibetan capital on August 3 were brought to a satisfactory issue early in September, when the treaty, to which, through the great tact and perseverance of Colonel Younghusband, the adhesion of the Tibetan authorities had at last been secured, was signed with due ceremony in the famous palace of Potala. Owing to the flight of the Dalai Lama, the Tibetans were represented during the negotiations by a regent and members of the Council of State, the Chinese Amban assisting in the discussions and, by the weight of his influence, doing much to bring about the successful result. On September 4 a preliminary function took place, at which the draft treaty was sealed by the regent. The formal ceremony, however, occurred on September 7, when the full convention was signed in the Potala in the presence of the Amban, the Tongsa Penlop of Bhutan, and the Nepalese resident. The seal of the Dalai Lama was affixed by the Regent, after which the seals of the Council, of the three great Monasteries, and of the National Assembly were added, Colonel Younghusband, the British Commissioner, then signing the document. In order to become fully valid, it has still to obtain the formal sanction of the Court of Peking, though of the ultimate acquiescence of this there seems little doubt. The main provisions of the treaty are said to be as follows, though no official version has yet been made public. The Tibetans are to re-erect the boundary stones at the Sikkim frontier; to establish marts at Yatung, Gyangtse, and Gartok for the furtherance of mutual trade; to adhere to a tariff to be agreed upon by the two countries; to pay an indemnity; and to demolish all forts on the trade-routes between the Indian frontier and Gyangtse. They also undertake not to make over Tibetan territory to any foreign Power without the consent of Great Britain, nor to permit foreign Powers to intermeddle in the Government or to construct roads or railways, open mines, etc. The Tashi (or Teshu) Lama of Shigatse has been proclaimed as the religious head of the country in the place of the Dalai Lama. The cordial relations established with the Tibetans as a whole are matter of much satisfaction, and both Colonel Younghusband and Brigadier-General Macdonald (both of them distinguished in the past for their geographical achievements) are to be warmly congratulated on the completion of their difficult mission.

Population of the Philippines.—The first Bulletin of the Census of the Philippine Islands, 1903, contains detailed tables of the population classified by provinces and commandancias, by islands, and by the smaller subdivisions of municipalities and barrios. There is hardly any attempt, however, to present the results in a generalized form, apart from the subdivision of the total number of inhabitants into civilized and wild. The number of the former is given as 6,987,686, of the latter as 647,740, the grand total being 7,635,426. It is evident, however, that the figures given in the case of the wild inhabitants are estimated only, as they frequently appear as even hundreds or even thousands under the separate islands. The number of Negritos still remaining is estimated at 23,000, and they are said to be found in 22 provinces out of the total 50. The civilized population was grouped for the purposes of the census into the eight tribes of the Bicol, Cagayan, Ilocano, Pampangan, Pangasinan, Tagalog, Visayan, and Zambalan, the Visayan being the most numerous. No figures are, however, given in the present bulletin for the totals of each. The following are the figures for the total population of the more important islands: Bohol, 243,148; Cebu, 592,247; Leyte, 357,641; Luzon, 3,798,507; Mindanao, 499,634; Negros, 460,776; Panay, 743,646 Samar, 222,690. The total area of the islands is given as 115,026 square miles, or 73,616,640 acres, of which over 61,000,000 acres are public land. Of the latter 40,000,000 are forest lands, the rest being available for agriculture.

AFRICA.

M. Villatte's Surveys in the Central Sahara.—The last two numbers of *La Géographie* (July and August, 1904) contain further details respecting the work of M. Villatte, to which allusion was made in the September number of the *Journal*. A sketch-map is given, showing the general direction of the route, which led almost due south from Insalah, past Inzize and Timissao, terminating at the well of Tin-Zawaten on the Adrar plateau, just south of 20° N., in about 2° 25′ E. of Greenwich.* The more easterly return route skirted the Ahaggar *massif*, and crossed the Muidir plateau. The Adrar of the Ifoghas (not to be confounded with the Adrar in the Western Sahara, the name being used generically for a mountainous district), which had never before been visited by Europeans, is a vast granite plateau 2600 feet in average altitude, with ridges rising 1000 to 1300 feet above its surface. The first part of the return journey, which was begun on May 1, was trying on account of the length of the stages, the heat, and especially the scarcity of water; the wells, found at great intervals, giving a very scanty supply. Between 22° and 23° N. the ground for a distance of 30 miles was covered with volcanic *débris*, while some of the hills had every appearance of being extinct craters. About Tit, just north of 23°, the mountains are granitic. M. Foureau, in communicating this news, expressed the opinion that, as he had maintained for some time, the whole of the mapping of this region must, as a result of M. Villatte's survey, be shifted a considerable distance to the east. North of Tit the route traversed a country composed of chains running north-and-south, travelling in that direction being thus easy, while in an east-west direction it is proportionately difficult. Later, M. Villatte passed along the Tifedest *massif*, which ends towards the north in the Garet-ed-Jenun, a fine granite mountain, rising 2600 to 3000 feet above the plain. On reaching Insalah once more he compared his aneroid with the mercurial barometer which he had left behind there, and found that the correction necessary was identical with that noted before the expedition was made. His altitudes will, therefore, merit some confidence. He kept a daily meteorological record, and a comparison of his barometric observations with those made at Insalah brought out some interesting results, throwing light on the course of depressions in the Sahara, which seem sometimes to extend over a wide area.

The Cairo Observatory.—We are informed by the acting director of the Egyptian Survey Department that on January 1 of this year, the Abbasia Observatory was transferred to its new site at Helwan, about 14 miles south of Cairo. The site is on the desert plateau above the town, and the buildings have an open view across the desert to the north, east, and south, while on the west is the Nile valley. A complete meteorological equipment and time-signal arrangement has been installed, and there is a transit house and an equatorial house, while a house for magnetic self-registering instruments is being constructed. The transit pillar is in lat. 29° 51′ 33″·5 N., long. 31° 20′ 30″·2 E., the latter value depending on that of the Venus station in the Mokattam hills (31° 16′ 33″·6 E.). The altitude of the cistern of the barometer above mean sea-level at Alexandria is 377·4 feet.

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* The above is the longitude given in the sketch-map in the August number of *La Géographie*; in the former number the position of Tin-Zawaten was said to be in 1° 30′ E. [of Paris], *i.e.* 3° 50′ E. of Greenwich.

Opening of the Senegal-Niger Railway.—The railway from Kayes on the Senegal to Bamako on the Upper Niger, the construction of which was first commenced some twenty years ago, has been at last completed, the first train having reached Bamako in May last. The total length is 310 miles. For a time it seemed that, owing to the unexpected difficulties encountered, the railway would not advance beyond Bafulabe on the Upper Senegal, which was for some time the terminus. About 1896, however, a new effort was made to continue the line to the Niger, and it has now been crowned with success, although the importance of the line has somewhat diminished since the project for a railway from Konakri on the coast of French Guinea to the Upper Niger, by a route no longer than that of the older scheme, and avoiding the difficult navigation of the Senegal, took shape. The first section of this latter line, 92 miles long, was also opened for traffic in May last.

West African Frontier Delimitations.—Surveys for the purpose of boundary delimitation have lately been made, as our readers are aware, both on the frontier between the Kamerun and Northern Nigeria, and between the German colony of Togo and the Gold Coast. With regard to the first, some difference of opinion seems to have prevailed regarding the position of Yola, the exact fixing of which was one of the main tasks of the commission. According to a note in *Globus* (vol. 86, No. 9), the determination of the longitude of Yola by the German commission (which was under the experienced leadership of Captain Glauning) depended on three observations of the altitude, and six of the right ascension, of the moon, carried out with a transit instrument; and the result is said to merit complete confidence, when the observations shall have been fully worked out. The boundary from Yola to Lake Chad was carefully triangulated, so that, once the position of Yola is fixed, the rest will follow as a matter of course, the only divergence of opinion being in regard to the exact spot at which the boundary may be said to strike the lake-shore—at the limit of extreme inundation or otherwise. This is a point to be settled by the two Governments. With regard to the Togo—Gold Coast boundary, the survey of which was begun by a joint commission in 1902, there has been some difficulty in arriving at a mutual agreement regarding the position of the frontier through a portion of the old neutral zone, but this is said to have now been eliminated, though details of the arrangement have not been made public. An excellent map of the more northern section of the frontier, between 10° and 11° N., is given in the latest number of the *Mitteilungen aus den Deutschen Schutzgebieten* (1904, No. 3), as an accompaniment to a paper by Count Zech, one of the German commissioners. This paper gives valuable information on the peoples of the region in question, their manners and customs.

AMERICA.

Lakes Titicaca and Poopo.—As has already been mentioned in the *Journal*, a scientific study of these lakes has lately been carried out by Dr. Neveu-Lemaire, one of the members of the French expedition to Bolivia under M. de Créqui-Montfort. The principal results as regards the physical geography of the lakes were outlined by Dr. Neveu-Lemaire in the June number of *La Géographie* (vol. ix. No. 6). The area of the water surface of Titicaca is estimated by the writer at 5100 square kilometres (1970 square miles), current estimates being, as a rule, much too high, as they include the area of the islands and peninsulas. About 120 soundings were effected, the Belloc sounding machine, as modified by Prof. Thoulet, being employed whenever the depth was greater than 10 metres. Dr. Neveu-Lemaire gives a bathymetric map on which the contours of 25, 100, and 200 metres are drawn. The deepest area lies nearer the north-east than the south-west shore, the contour-line of 200 metres approaching comparatively close to the former in two separate parts, while on the opposite side a wide band of regular breadth, with depths intermediate between 100 and 200 metres, runs parallel to the south-west shore. Soto island, the furthest from the shore of all the islands of the lake, rises abruptly from the deepest part, 270 metres (886 feet) being found at a little distance from its south end on the landward side, while the maximum depth (272 metres, or 892 feet) was found abreast of the island on the major axis of the lake. The "Little lake," joined to the "Great lake" in the south by a strait, is shallow, though the strait itself is fairly deep. Observations of much interest were obtained regarding the temperature of the lake water, though the stay was not long enough to throw light on seasonal variations, all the observations being made in early winter. The surface temperature was found to rise, as a rule, until 3 p.m., and then to fall again; but the greatest variation observed in a single day was 2°·82 Fahr., and this at a part of the lake where the depth varied greatly. The lowest surface temperatures observed naturally occurred in the shallow bays. The figures relating to the bottom temperatures are striking from their great regularity in spite of great differences of depth, the extreme variation being only 3°·6 Fahr. (from 48°·9 to 52°·5 Fahr., at 10 feet and 60 feet respectively). Below 240 metres (787 feet) the temperature was constant at 50°·82, the maximum being reached between 490 and 656 feet. A series of vertical temperatures near the centre of the lake showed a difference of only 1°·7 between the surface and the bottom. Observations were also taken of the transparency of the water, and of the climatic conditions, flora and fauna, etc., of the surrounding country. The level of the lake rises during the summer, the amount in 1903 being said to have been 5 inches; but apart from seasonal variation, the level is sinking progressively. Lake Poopo is very shallow, two small areas in the centre alone having a depth above 6½ feet (maximum 13 feet). It is evidently doomed to disappear in course of time.

Aves Island.—In the note of this island, in the September number, the latitude should read as 15° 38′ N., not 13° 38′, the latter figure being due to a printer's error.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Changes of Level in the Mediterranean.—The evidences for considerable changes in the relative levels of the land and sea in the Mediterranean basin within the historical period continue to accumulate. The results of Mr. R. T. Günther's researches on the coasts of Southern Italy have from time to time appeared in the *Journal*, while at the recent meeting of the British Association he called attention to other points on the Italian shores, at which similar changes can be proved to have taken place. Mr. Hogarth and others have seen similar evidences in North Africa (Cyrene and Egypt), while the same story comes from the European side of the Eastern Mediterranean. M. P. Negris has put before the Paris Academy of Sciences (*C.R.*, vol. 137, p. 222; vol. 139, p. 379) facts which he has observed in Greece and the Archipelago which all tend to prove that the relative level of the sea in this region has risen about 3 metres, or 10 feet, since the time of the Romans, and still more if we go back to an earlier date. The evidence is supplied by breakwaters and other artificial structures which are now submerged, though the purposes for which they were made show that originally they must have stood above sea-level. They occur at spots separated by wide intervals, viz. in the island of Leucadia (Santa Maura); at Itea, in the bay of Amphissa (Gulf of Lepanto); on the island of Ægina; and on Rhenea, or Great Delos; and the general agreement as regards the amount of change at all these places certainly seems to suggest the conclusion arrived at by M. Negris, that it is the sea-level and not that of the land which has fluctuated. Mr. Günther, it will be remembered, considered that the latter was the unstable element, and no doubt, in the volcanic region with which his researches were concerned, this would be the case. M. Negris seems to have found no trace of a land-level in mediæval times, still lower than the present, such as was demonstrated by Mr. Günther. It is to be hoped that the attention which has been attracted to the subject will lead to a more thorough search for evidences of fluctuation over the whole area, and that the doubtful points will in course of time be set at rest.

The Maximum Inclination of Screes and Talus-Slopes.—This subject has been investigated by Herr A. Piwowar, who gives the results of a large series of measurements in the *Vierteljahrschrift der Naturforschenden Gesellschaft in Zürich* for 1903. The writer finds that the angle of slope depends, most of all, on the *fracture* of the rocks which compose the heaps as determined by their internal texture and structure. The more massive, angular, and coarse-grained the rock, and the rougher its fracture, so much steeper will be the screes formed from it. On the other hand, the more laminated, rounded, and fine-grained the rock, and the smoother its fracture, so much more gradual will be the slope of its *débris*. The angle of slope is, in fact, a direct measure of the friction between the fragments of rock. Granite, a rock of the first category, was found to give a maximum angle of slope of 37°; while clay-slate, a laminated rock with smooth fracture, gave only 27½°. Intermediate between these extremes come rocks which are at the same time coarse-grained and laminated (*e.g.* gneiss or mica-schist), or which are smooth in fracture but massive (some kinds of limestone). These showed angles varying from 34° to 30°. Rocks which break into more or less flat fragments with smooth surfaces show a much greater constancy in the angle of slope than massive rocks, *e.g.* in the case of gneiss, the maximum and minimum observed differed only by 1° (34° and 33°), while in the case of granite the difference amounted to 11°. In the case of a mixture of rocks of different categories the angle is an intermediate one. It does not appear that the height of the cliff from which the *débris* has fallen exercises much influence, though there was some indication that a greater height of cliff gives a slightly smaller angle. Differences of aspect, with a corresponding difference in exposure to climatic factors, do not seem, either, to be of much importance. In the case of similar material, angularity of the fragments may increase the angle by as much as 3°. Slopes overgrown with vegetation may either be steeper or less steep than bare slopes. In the former case the result would be due to the compacting agency of the roots and humus, while in the latter the growth of the plants may be due to the greater age of the slopes, which would lead to a reduction of their angle of slope. The presence of water seems to reduce the angle, especially in the case of talus-slopes composed of small, smooth, or flat fragments. The average size of the fragments seems comparatively unimportant, although they are always arranged in the talus according to size, the largest lowest. Lastly, the writer found that under-water *débris*-slopes are about 1½° steeper than similar slopes exposed to the atmosphere, the effect of diminished weight outweighing that of diminished friction.

The Fifth Scientific Expedition of the "Princess Alice II."—The Prince of Monaco contributes a note to the *Comptes Rendus de l'Académie des Sciences* (vol. cxxxviii. No. 23, 6 juin, 1904), on the results of his latest expedition in the Bay of Biscay. Eighteen soundings, the deepest 4835 metres (2641 fathoms), were made with the Buchanan sounder furnished with a new tube which permitted longer cores to be obtained, revealing sudden variations in the composition of the bottom. Two dredgings at depths of 820 metres (448 fathoms), some 200 miles off Ushant, brought up many crystalline stones, about 100 kgs. (220 lbs.) in weight, undoubtedly of Northern origin transported by ice. Strong currents affect the water here to the very bottom. Prof. Thoulet, who accompanied the Prince, found out that certain coastal bottom deposits, treated with acids, gave off sulphuretted hydrogen; he verified the alteration in the buoyancy of pumice on sinking pieces to great depths; and made use of a mirror inclined to 45° looked at vertically when immersed to slight depths for judging the colour of the sea. Temperature observations were made at 50, 100, 150 metres (27, 54, and 82 fathoms), and in three instances at 500, 1000, and 1500 metres. Samples of water obtained below 1500 metres (820 fathoms) were occasionally slightly opaline, owing to suspended mud, although the bottom was 2000 to 3000 metres deeper. Many deep-sea dredgings of zoological interest were made, but the most important investigations were those on the sardines and the plankton on which they feed off the coast of Britanny. A rare medusa was taken from 1700 metres (930 fathoms), where the bottom was at 4360 metres (2383 fathoms), and several new species of crustaceans were netted.

GENERAL.

Routes from America to Eastern Asia.—In the Seattle *Post-Intelligencer* for May 15, 1904, Mr. A. J. Roewade refers to the misconceptions frequently prevailing, owing to the distortion due to the map-projections in common use, as to the most direct routes between the United States and Eastern Asia. He gives sketch-maps showing the direction taken by arcs of great circles between Puget sound and Yokohama, Irkhutsk, Calcutta, and the Philippines, which will no doubt cause surprise to many. Thus the most direct route from the north-westerly point of the United States to Calcutta passes through the centre of Alaska and *north* of Bering strait, passing only just to the south of Irkhutsk in its further course. Again, that from Cape Flattery, Washington, to Cape Bojeador in the Philippines, passes through the southern peninsula of Alaska and the island of Yezo, leaving the greater part of the island of Hondo on the outside. The conclusions drawn are that the project of a railway through Alaska and North-Eastern Siberia may be quite practicable in course of time, and that a great future lies before any halfway port that may be established by the United States in the Aleutian archipelago. The spot suggested for such a port is on Kiska island, where the United States Government is now preparing to establish a fortified coaling station.

OBITUARY.

Friedrich Ratzel.

In Friedrich Ratzel, who died suddenly on August 9 at Ammerland, on the Lake of Starnberg, the geographical world has lost one of its most learned and brilliant representatives.

Born at Karlsruhe on August 30, 1844, young Ratzel began life as an apothecary's apprentice at the village of Eichtersheim, lying in the midst of a charming hill country between Heidelberg and Heilbronn. Having passed his pharmaceutical examination, he was occupied for some time as assistant in dispensaries at Mörs and at Rupperswyl, in Switzerland. During all this time he devoted his spare time to earnest study, whilst numerous pedestrian excursions supplied him with as many object-lessons in a knowledge of Nature, for which he had an abiding love. At length his parents yielded to his earnest desire that he might receive the benefits of a university training. At Heidelberg, Jena, and Berlin he studied natural science, and especially zoology, and in 1868 the first of these universities conferred upon him the degree of PHIL.DR., on the strength of a paper on the Oligochæta, a group of the Annelides. The winter of 1868–9 he spent at Montpelier and Cette, in intimate intercourse with the famous zoologist, Charles Martin. The "Zoologische Briefe vom Mittelmeer," which he addressed at that time to the *Kölnische Zeitung*, were so highly appreciated that the proprietors of that influential journal engaged him as a special travelling correspondent, thus realizing one of his most earnest desires by enabling him to gain a personal knowledge of a considerable portion of the Earth's surface. His travels, first of all, took him through Hungary, Transylvania, Italy, and Sicily, but on the outbreak of the Franco-German War in 1870, he joined a Baden regiment of infantry as volunteer, was seriously wounded at Auxerre, and returned home an invalid, but the proud possessor of the Iron Cross.

The year 1871 was profitably spent by him as a student at Munich, where the influence of Zittel, the geologist, and Moritz Wagner, the naturalist, determined his future career as a geographer.

In 1872 he resumed his work as a travelling correspondent, visiting in succession Italy and Sicily, the United States, Mexico, and Cuba. The works in which he renders an account of these travels—'Wandertage eines Naturforschers' (1873–4), 'Städte- und Kulturbilder aus Nordamerika' (1876), and 'Aus Mexiko' (1878)—abound in delightful sketches of land and people.

On his return from America in December, 1875, Ratzel qualified as *Docent* in geography at the Technical High School at Munich, by presenting an essay on Chinese emigration ("Die chinesische Auswanderung," 1876). In the following year he was appointed Professor. In 1886 he succeeded Peschel and Richthofen as Professor of Geography in the university of Leipzig, a position which he held up to the time of his premature death.

Ratzel was an indefatigable student, and a ready, voluminous writer. In numerous essays he dealt with nearly every branch of geographical study. In all he wrote he proved himself an original thinker, a careful observer, and a master of literary style. For a complete list of his works up to 1901, we must refer to the first report of the *Geographische Abende*, published by the Union of Leipzig Geographers. In what follows we shall refer only to his principal works, which have made his reputation, and have ensured him a place among the geographical thinkers of all time.

The first of these works, apart from books of travel already referred to, has for its title, 'Die Vereinigten Staaten von Nordamerika' (1878, 1880), a work dealing with the physical and political geography of the great American Union, which Elisée Réclus refers to as "perhaps the best and most complete treatise on the United States in any language."

His next work, 'Anthropogeographie' (i. 1882, 2nd edit. 1899; ii. 1891), is far more ambitious in its scope. It traces and exhibits the influence which the physical facts and environment have exercised and are exercising upon the history of mankind.

Of course, this philosophical method of dealing with geography was not new. Carl Ritter, not to trace its origin further back, had already laid down its principles in 1818, in the *Einleitung* to his general comparative geography, and it had been employed with more or less success by many pupils and followers of Ritter, among whom may be mentioned J. G. Kohl, E. Kapp, Guyot, C. F. A. Maury, and others, but it had never before been dealt with as comprehensively and thoroughly as was done by Ratzel. He must likewise be credited with having introduced the term "anthropogeography" in substitution for the rather vague terms of "general comparative" or "historical geography;" and although this term was at first objected to, it has now been fairly generally accepted by geographers.

Quite equal, if not superior, in merit to the work just mentioned, is the 'Politische Geographie,' published in 1897 (2nd edit. 1903), which applies the same comparative method when dealing with the 'Geography of States, Commerce and War,' a work well deserving the attention of statesmen and those aspiring to dispose of the destinies of states.

More popular in character is the 'Völkerkunde' (1885–8), a work rendered accessible to the English public by Mr. A. J. Butler's excellent translation ('The History of-Mankind,' 1896–8). Another work of the same stamp is 'Die Erde und das Leben' (1901–2), described as a 'Comparative Geography' in the title; a short review of which will be found in the *Geographical Journal* (vol. xix. p. 500).

Shortly before his death, Ratzel published a work on the aspects of Nature ('Naturschilderung,' 1904); but a more ambitious work, upon which he had been employed for several years, and which was to have dealt with Biogeography in its widest sense, it was not given him to complete.

As a university professor, Ratzel exercised a wide and beneficent influence. His lectures, which dealt with every branch of geographical inquiry, were attended latterly by two or three hundred students, among whom were many foreigners. If the teaching of geography in Saxon schools compares favourably with what is done in other states of Germany, this, in no small measure, is due to his influence. His students revered their teacher, and on the twenty-fifth anniversary of his appointment as professor, they presented him with a "Ratzel Fund," the interest of which is to be devoted to assist geographical students in their researches. Among many pupils who enjoyed the advantage of his teaching, and who now occupy respected positions in the world of science, we may mention Prof. E. Oberhummer, of Vienna; Prof. Hassert, of Cologne; Prof. Werle, the director of the Anthropological Museum of Leipzig; A. M. Eckert, *Docent* in geography at Kiel; and H. F. Helmolt, the historian.

E. G. R.

Sir Michael Biddulph.

General Sir Michael Biddulph, R.A., G.C.B., etc., died on July 23 last, in his eighty-second year, at his residence in Whitehall Court. He had been a member of the Society since 1880. The deceased officer was the son of the Rev. T. S. Biddulph, of Amroth Castle, Pembrokeshire, and was educated at the Royal Military Academy, entering the Royal Artillery in 1843. He served with distinction throughout the Crimean war, but the greater part of his military service was connected with India. From 1876 to 1878 he was in command of the Rohilkand district, afterwards commanding the Quetta field force and the second division of the Kandahar field force during the Afghan war of 1878–79. During the campaign he and his troops made many long and trying marches, pushing their way as far as the Helmand river.

This work gave some scope for his geographical leanings in a country then but imperfectly known, and during a short furlough, in 1880, he read before the Society a valuable paper on 'Pishin and the routes between India and Candahar,' which was printed in the *Proceedings* for that year, illustrated by excellent sketches of the country. Indirectly he had done much to further geographical knowledge by the help and encouragement he gave to the survey officers deputed to work with his column, among whom were included men afterwards well known in the geographical world, such as Sir Thomas Holdich, General Woodthorpe, and Colonel Tanner. Leaving India in 1886, Sir Michael became president of the Ordnance Committee, a post which he held till 1889. He was Groom-in-Waiting to Queen Victoria for a number of years, and Keeper of the Regalia at the Tower of London from 1891 to 1896, when he became Gentleman Usher of the Black Rod, retaining the post till his death.

Major G. H. Bretherton.

The country has lost the services of a most promising officer by the death of Major G. H. Bretherton, D.S.O., which occurred by drowning in the Sanpo during the crossing of that river by the British expedition *en route* for Lhasa. He was born in 1860, the son of the late Edward Bretherton, of Clifton, and entering the army served in Egypt and on the north-west frontier of India, where he was for some years on special duty in Gilgit and Kashmir, doing excellent service. He had been chief transport officer to the Tibet expedition, and in this capacity performed arduous and invaluable services in the face of great difficulties. A journey which he made in 1901 by a new route across the Himalayas, from the Indus to the Kashmir valley, was briefly described in the *Journal* for May, 1902.

The Hon. John Douglas.

The Hon. John Douglas, Governor of Thursday island, whose death, on July 23 last, we regret to record, was an old member of our Society, having joined in 1870. He was born in 1828, and his father, the late Henry A. Douglas, was brother of the fifth and sixth Marquises of Queensberry. After graduating at Durham University in 1850, Mr. Douglas settled in New South Wales, and in 1859 and following years had a seat in the parliament of that colony. But in 1863 he moved to Queensland, with which he maintained his connection during the remainder of his life, holding various posts in the government, and representing the colony as Agent-General in London in 1870–71. In 1878 he became Colonial Secretary, and in 1885 Resident at Thursday island, returning to the same post in 1889, after holding the post of Special Commissioner for British New Guinea for three years, after the death of Sir Peter Scratchley. He had remained in charge at Thursday island until the last, his death occurring on the island. He was the author of interesting papers on Thursday island and Torres strait, published in the *Queensland Geographical Journal* and elsewhere.

The Rev. François Coillard.

Since the Upper Zambezi region was first opened to civilizing influences by the labours of Livingstone, no one man has been so completely identified with the furtherance of the good work so inaugurated as the Rev. F. Coillard, whose death, we regret to record, took place at Lialui on May 27 last. M. Coillard, as is well known, was a French Protestant missionary, who began work in Basutoland in 1857, afterwards pushing further into the interior, and finally establishing a mission in the Barotse country over twenty years ago. Every traveller who has since visited that region has borne testimony to the excellence of his work, which he had begun to see bearing fruit in spite of many discouragements. M. Coillard married, in 1860, a daughter of the Rev. L. Mackintosh, of Edinburgh; and was throughout a warm advocate of the extension of British influence in the Zambezi basin, as furthering the best interests of the native races. In 1897–98, M. Coillard published, both in English and French, an account of his labours, which incidentally supplied valuable information on the Marotse and their country.

CORRESPONDENCE.

The Survey of Canada.

The August number of the *Journal* contains a review on my "Report on the Survey of Canada," wherein the reviewer attributes to me the strange opinion that an absolute determination of longitude can be made with about the same degree of accuracy as that involved in a determination of latitude. I am afraid a carelessly worded sentence must have misled him. I certainly never entertained such an idea, and I fully concur that absolute determinations of longitude, *i.e.* determinations other than those made by exchange of telegraphic signals, have no place in a scientific survey.

E. H. Hills.

War Office, Sept. 19, 1904.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Col. = Colonies.
Com. = Commerce.
C. R. = Comptes Rendus.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Is. = Izvestiya.
J. = Journal.
Jb. = Jahrbuch.
k. u. k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. (Mém.) = Memoirs, Mémoires.
Met. (mét.) = Meteorological, etc.
P. = Proceedings.
R. = Royal.
Rev. (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Italy. **Baedeker.**

Italy from the Alps to Naples. Handbook for Travellers, by Karl Baedeker. Leipsic: Karl Baedeker, 1904. Size 6½ × 4½, pp. xlii. and 424. *Maps and Plans. Price* 8*m*. *Presented by the Publishers.*

Italy—Bibliography. *Rev. G. Italiana* 10 (1903): pp. 112. **Magistris.**
Bibliografia Geografica della regione Italiana, Anno ii., 1902.

Italy—Geodesy. **Cattolica.**
Operazioni Astronomico-Geodetiche eseguite negli anni 1901–02 a Portofino (Monte del Telegrafo) nell' Isola Maddalena (Semaforo Guardia Vecchia) ed a Livorno (Accademia Navale). Resoconto del Cap. P. L. Cattolica. Genova, 1904. Size 13½ × 9½, pp. x. and 82. *Presented by the R. Istituto Idrografico, Genoa.*

Italy—Hydrography. **Cattolica.**
V° Congresso Geografico Italiano, Napoli, 9 Aprile 1904. Lo stato attuale della Cartografia Nautica Italiana ed i lavori delle future campagne idrografiche. Comunicazione del Capitano P. L. Cattolica. Genova, 1904. Size 11 × 8, pp. 8. *Index Maps. Presented by the R. Istituto Idrografico, Genoa.*

Italy—Sardinia. *B.S.G. Italiana* 5 (1904): 315–351. **Gestro.**
Una gita in Sardegna. Divagazioni biogeografiche del dott. R. Gestro. *With Sketch-maps and Illustrations.*

Italy—Sicily—Rivers. *Atti R.A. Lincei, Rendiconti* 13 (1) (1904): 707–713. **Eredia.**
Sulla previsione delle piene dei fiumi in Sicilia. Nota del dott. F. Eredia.

Norway—Glommen. *Norske G.S. Aarbog* 14 (1902–3): 96–102. **Reusch.**
Glommens bøining ved Kongsvinger. Af Dr. Hans Reusch.

On the origin of the bend of the Glommen at Kongsvinger.

Norway—Orography—Historical. *Norske G.S. Aarbog* 14 (1902–3): 1–36. **Haffner.**
Det norske fjeldsystem. Af Einar Haffner.

Mainly on the historical development of a knowledge of the mountains of Norway.

Rumania. **Sturdza.**
Alexandre A. C. Sturdza. La Roumanie n'appartient pas à la péninsule balkanique proprement dite ni comme sol, ni comme race, ni comme état. Traduction Française. Bucarest: J. V. Socecu, 1904. Size 9½ × 6½, pp. 32. *Maps. Presented by the Societatea Geografică Romînă.*

Urges that Rumania should not be included by map-makers as part of the "Balkan Peninsula." (See note in the Monthly Record for September, p. 345.)

Russia. ——
Commercial Russia in 1904. Area, population, finances, currency, railways, industry and agriculture, and Foreign Commerce and Commerce of United States with Russia. [From the *Monthly Summary of Commerce and Finance* for February, 1904.] Washington, 1904. Size 11½ × 9, pp. 2755–2870. *Map.*

Russia—Black Sea Coast. *Scottish G. Mag.* 20 (1904): 285–305. **Dingelstedt.**
The Riviera of Russia. By V. Dingelstedt. *With Illustrations.*

Russia—Finland. **Heinrichs.**
Observations météorologiques publiées par l'Institut Météorologique Central de la Société des Sciences de Finlande. État des glaces et des neiges en Finlande pendant l'hiver 1892–1893 exposé par Axel Heinrichs. Kuopio: Imp. K. Malmström, 1904. Size 15 × 10, pp. 78. *Maps.*

Scheldt. *B.S.R. Belge G.* 28 (1904): 97–109. **Cornet.**
L'Orientation des Vallées dans le bassin de l'Escaut. Par J. Cornet.

Sweden—Flora. **Schulz.**
A. Schulz: Ueber die Entwicklungsgeschichte der gegenwärtigen phanerogamen Flora und Pflanzendecke Schwedens. (Sonderabdruck aus den Berichten der Deutschen Botanischen Gesellschaft., Jahrg. 1904. Band XXII., Heft 2.) Berlin: Gebrüder Borntræger, 1904. Size 10 × 6½, pp. 133–143. *Presented by the Author.*

Combats some of the views put forward by Dr. Gunnar Andersson.

Switzerland. **Coolidge.**
Conway and Coolidge's Climbers' Guides. The Bernese Oberland. Volume ii. From the Mönchjoch to the Grimsel. By W. A. B. Coolidge. London: T. Fisher Unwin, 1904. Size 5¼ × 4, pp. xxviii. and 196. *Price* 10s. *Presented by the Publisher.*

Switzerland. *Le Globe, B.S.G. Genève* 43 (1904): 23–30. **Krafft.**
Le lac d'Ægeri et Morgarten. Par A. Krafft. *With Map.*

Switzerland. ——

Handbook for Switzerland and the Adjacent Regions of the Alps. Nineteenth Edition. London: E. Stanford, 1904. Size 7 × 5, pp. cvi. and 556. *Maps and Plans. Price* 10*s*. *Presented by the Publisher.*

This edition has been completely remodelled and thoroughly revised, with a view to bringing it into line with the changed conditions of modern travel, and in the hope that it may "become as indispensable to travellers in Switzerland as in former days the earlier editions were to the predecessors of the present race of Swiss tourists."

Switzerland. **Stebler.**

Das Goms und die Gomser. Von F. G. Stebler. (Beilage zum Jahrbuch S.A.C., Band xxxviii.) Zürich: F. Amberger vorm. D. Bürkli, 1903. Size 10½ × 7½, pp. viii. and 112. *Map and Illustrations.*

Switzerland—Flora. **Schulz**

Entwickelungsgeschichte der gegenwärtigen phanerogamen Flora und Pflanzendecke der Schweiz. Von A. Schulz. (Abdruck aus: Beihefte zum Botanischen Centralblatt, Band XVII., Heft 1, 1904.) Jena: G. Fischer. Size 9½ × 6½, pp. 157–194. *Presented by the Author.*

Criticizes the recent work of Marie Jerosch (cf. *ante*, p. 333).

Switzerland—Geographical Dictionary. **Knapp, Borel, and Attinger.**

Geographisches Lexikon der Schweiz mit dem Beistande der Geographischen Gesellschaft zu Neuenburg herausgegeben unter der Leitung von C. Knapp, M. Borel, und V. Attinger. . . . Deutsche Ausgabe besorgt von H. Brunner. Zweiter Band. Emmenholz—Krailalppass. Neuenburg: Gebrüder Attinger, 1904. Size 11 × 7½, pp. viii. and 768. *Maps and Illustrations. Presented by Herr H. Brunner.*

Switzerland—Hydrology. ——

Table de Récapitulation des Principaux Résultats des Observations hydrométriques suisses pour l'année 1893. Ditto 1899. Bern, 1903. Size 15 × 10, pp. 40 and 52.

Switzerland—Hydrology and Meteorology. ——

Tableaux graphiques des Observations hydrométriques suisses et des températures de l'air et des hauteurs pluviales pour l'année 1902. Bern, 1903. Size 15½ × 10, pp. 20. *Diagrams.*

Switzerland—Population. *Jahresb. G. Ges. Bern* **18** (1900–1902): 129–167. **Zivier.**

Die Verteilung der Bevölkerung im Oberrheingebiet nach ihrer Dichte. Ein Beitrag zur Anthropogeographie des Kantons Graubünden. Von Dr. H. Zivier. *With Map.*

Switzerland—Relief. *Jahresb. G. Ges. Bern* **18** (1900–1902): 1–38. **Liez.**

Die Verteilung der mittleren Höhe in der Schweiz. Von Dr. H. Liez. *With Maps.*

Turkey—Bosporus. *Deutsch. Rundschau G.* **26** (1904): 393–397. **Braun.**

Griechische Walddörfer am Bosporus. Von F. Braun.

United Kingdom—Ireland. **Lamplugh and others.**

Memoirs of the Geological Survey, Ireland. The Geology of the country around Belfast. (Explanation of the Belfast Colour-printed Drift Map.) By G. W. Lamplugh, J. R. Kilroe, A. M. Henry, H. J. Seymour, W. B. Wright, and H. B. Muff. Dublin; London: E. Stanford, 1904. Size 10 × 6½, pp. viii. and 166. *Illustrations. Price* 3*s*.

ASIA.

Chinese Empire—Tibet. *Iz. Russian G.S.* **39** (1903): 437–479. **Grum-Grjimailo.**

Contribution to the Ethnology of Amdo and Kuku Nor district. By G. E. Grum-Grjimailo. [In Russian.]

Chinese Empire—Tibet. *Petermanns M.* **50** (1904): 107–112. **Schlagintweit.**

Tibet. Von Dr. E. Schlagintweit. *With Map.*

Chinese Empire—Tibet. *Z. Ges. Erdk. Berlin* (1904): 328–361. **Tronnier.**

Die Durchquerung Tibets seitens der Jesuiten Johannes Grueber und Albert de

Dorville im Jahr 1661. Eine Studie über das Leben und die Reise der beiden Väter. Von R. Tronnier. *With Map.*

An abstract of this paper will be given elsewhere.

Chinese Empire—Tibet. *Monthly Rev.* 15 (1904): 41–54. **Wylly.**

British Relations with Thibet. By H. C. Wylly.

Eastern Asia. *Monthly Weather Rev.* 32 (1904): 124-125. **Garriott.**

Climate of Siberia, Korea, and Manchuria. By Prof. E. B. Garriott.

Eastern Asia. **Krahmer.**

Russland in Asien. Band vii. Die Beziehungen Russlands zu Japan (mit besonderer Berücksichtigung Koreas). Von Krahmer. Leipzig: Zuckschwerdt & Co., 1904. Size 9½ × 6½, pp. viii. and 222. *Map.*

French Indo-China. *B. Comité l'Asie Française* 4 (1904): 220–224. ——

Une Nouvelle Voie d'accès de la côte annamitique au Mékong. Par R. C. *With Map.*

India—Burma. **Nangle.**

The Burma Route Book. Part i. Routes in Northern Burma. Compiled by Captain M. C. Nangle, for the Intelligence Branch, Quarter-Master General's Department, Simla. 1903. Calcutta, 1904. Size 13½ × 8½, pp. 206. *Index Map. Presented by the Intelligence Branch, Simla.*

India—Census. ——

East India (Census). General Report of the Census of India, 1901. London: Eyre & Spottiswoode, 1904. Size 13½ × 8½, pp. xxvi. and 582. *Maps. Price* 8*s.* 3*d.*

A most valuable account of the results of the census in a generalized form. It will receive special notice.

India—Himalayas. *Alpine J.* 22 (1904): 122–124. **Freshfield.**

How to climb Kangchenjunga: a Topographical Note. By D. W. Freshfield. *With Illustration.*

India—Himalayas. *Appalachia* 10 (1904): 241–255. **Workman.**

Ascent of the Great Chogo Loongma Glacier, and other Climbs in the Himalayas. By Fanny Bullock Workman. *With Illustrations.*

India—Kolar Gold Field. *B. Mysore Geolog. Dep.* No. 2 (1904): pp. 48. **Smeeth.**

Air Blasts and Quakes on the Kolar Gold Field. By W. F. Smeeth. *With Illustrations.*

India—Languages. *Imp. and Asiatic Quarterly Rev.* 17 (1904): 267–286. **Grierson.**

The Languages of India, and the Census of 1901. By G. A. Grierson.

India—North-West Frontier. ——

Administration Report of the North-West Frontier Province from 9th November, 1901, to March, 1903. Peshawar, 1903. Size 13½ × 8½, pp. iv., viii., and 76. *Presented by the Chief Commissioner North-West Frontier Province.*

Of special interest on account of the recent inauguration of the province, of the physical features and history of which a sketch is given.

India and Ceylon—Railways. **Trott.**

Index to all Railway and Military Stations, and Mileage Book for Trott's Coloured Map of Railways in India, Burma, and Ceylon, as compiled for the Bengal Nagpur Railway Company. By J. Harrington Trott. Calcutta, 1903. Size 13½ × 8½, pp. [18], xxxvii., and 60. *Map. Presented by J. H. Trott, Esq.*

Indian Ocean—Kerguelen Island. *Questions Dipl. et Colon.* 17 (1904): 748–753. **Bull.**

L'île de Kerguelen. Par H. J. Bull. *With Maps.*

Indian Ocean—Maldive and Laccadive Islands. **Gardiner.**

The Fauna and Geography of the Maldive and Laccadive Archipelagoes. Edited by J. S. Gardiner, Vol. ii., Part iii. Cambridge: the University Press; London: C. J. Clay & Sons, 1904. Size 11½ × 9, pp. 669-806. *Plates. Price* 15*s. net.*

All the reports in this part refer to animal life.

Indo-China. *La G., B.S.G. Paris* 9 (1904): 376-379. **Aitoff.**

Le traité franco-siamois. Par D. Aitoff. *With Map.*

On the map, the explanations of the two kinds of diagonal hatchings have been accidentally interchanged. The statement that the police of the provinces of Battambang, etc., is to be placed under French officers, is also puzzling.

Indo-China. *Deutsch. Rundschau G.* **26** (1904): 370–371. ———

Die neue französisch-siamesische Grenze. *With Map.*

Indo-China—Funan. *J. Asiatique* 1 (1903): 109–150. **Aymonier.**

Le Founan. Par É. Aymonier.

Indo-China—Mois. **Gautier.**

B.S.G. Com. Havre **19** (1902): 95–109, 172–182, 234–248; **20** (1903): 305–317, 371–379, 428–440.

Etude sur les Moïs. Par A. Gautier.

Japan. **Reynoso.**

En la Corte del Mikado. Bocetos Japoneses por D. Francisco de Reynoso. Madrid, 1904. Size 9 × 6, pp. xiv. and 448. *Presented by the Author.*

Japan. ———

Commercial Japan in 1904. Area, Population, Production, Railways, Telegraphs, and Transportation Routes, and Foreign Commerce and Commerce of United States with Japan. (From the *Monthly Summary of Commerce and Finance* for February, 1904.) Washington, 1904. Size 12 × 9, pp. 2873–3018. *Map.*

Japan. ———

Imperial Geological Survey of Japan, with a catalogue of articles and analytical results of the specimens of soils exhibited at the Louisiana Purchase Exposition held at St. Louis, Missouri, United States of America, in 1904. Tōkyō: The Imperial Geological Survey of Japan, 1904. Size 10½ × 7½, pp. 60 and 16. *Maps and Portraits.*

Contains a sketch of the history and work of the geological survey of Japan.

Japan—Geology. ———

Outlines of the Geology of Japan: Descriptive Text to accompany the Geological Map of the Empire on the Scale 1 : 1,000,000. Compiled by the officials of the Imperial Geological Survey of Japan, Department of Agriculture and Commerce. Tokyo: The Geological Survey, 1902. Size 9½ × 7, pp. vi. and 252. *Presented by the Imperial Geological Survey, Japan.*

See review in the September number, p. 335.

Korea. *Fortnightly Rev.* **75** (1904): 946–954. **Hillier.**

Korea: its History and Prospects. By Sir W. C. Hillier, K.C.M.G., C.B.

Korea. **Lay.**

Trade of Corea for the year 1903. Foreign Office, Annual, No. 3220, 1904. Size 10 × 6½, pp. 18. *Price* 1½*d.*

Korea. ———

Commercial Korea in 1904. Area, Population, Production, Railways, Telegraphs, and Transportation Routes, and Foreign Commerce and Commerce of United States with Korea. (From the *Monthly Summary of Commerce and Finance* for January, 1904.) Washington, 1904. Size 12 × 9½, pp. 2449–2482. *Maps.*

Malay Archipelago—Celebes. *Petermanns M.* **50** (1904): 128–129. **Foy.**

Ueber die Herkunft des Namens "Celebes." Von Dr. W. Foy.

Malay Archipelago—Celebes. *Petermanns M.* **50** (1904): 80. **Sarasin.**

Ueber die Herkunft des Namens "Celebes." Von Dr. F. Sarasin.

The explanation given was subsequently contested (see above).

Malay Archipelago—Sumatra. *Globus* **86** (1904): 24–30. **Hagen.**

Die Gajos auf Sumatra. Von Dr. B. Hagen. *With Illustrations.*

Philippine Islands. **Blair and Robertson.**

The Philippine Islands, 1493–1898. Edited and annotated by E. H. Blair and J. A. Robertson, with historical introduction and additional notes, by E. G. Bourne. Vol. xi., 1599–1602 (pp. 320); vol. xii., 1601–1604 (pp. 324); vol. xiii. 1604–1605 (pp. 318); vol. xiv., 1605–1609 (pp. 342); vol. xv., 1609 (pp. 332). Cleveland, Ohio: The Arthur H. Clarke Co., 1904. Size 10 × 6½. *Maps and Plates.*

Philippine Islands—Bibliography. **Griffin and Phillips.**

A List of Books (with references to Periodicals) on the Philippine Islands in the

Library of Congress, by A. P. C. Griffin, with Chronological List of Maps in the Library of Congress, by P. Lee Phillips. Washington, 1903. Size 11 × 7½, pp. xvi. and 398. *Presented by the Library of Congress.*

AFRICA.

British East Africa. *J. Anthrop. I.* 33 (1903): 325–359. **Hobley.**

British East Africa. Anthropological Studies in Kavirondo and Nandi. By C. W. Hobley. *With Plates.*

British East Africa—Kikuyu Language. **McGregor.**

English-Kikuyu Vocabulary. Compiled for the use of the C.M.S. Missions in East Africa. By A. W. McGregor. London: Society for Promoting Christian Knowledge, 1904. Size 6½ × 4½, pp. 192. *Presented by the Author.*

Congo—Fever. **Védy.**

La fièvre bilieuse hémoglobinurique dans le Bassin du Congo. Par le Dr. L. Védy. Bruxelles, 1904. Size 10 × 6½, pp. 116. *Presented by the Author.*

Congo State. *La G., B.S.G. Paris* 9 (1904): 431–444. **Brumpt.**

Mission du Bourg de Bozas. III^{e} Partie. Du Nil à l'Atlantique. Par E. Brumpt. *With Map.*

Congo State—Katanga. *Mouvement G.* 21 (1904): 169–174, 181–185. **Lattes.**

Les voies navigables au Katanga; reconnaissances du lieutenant Lattes. *With Maps.*

See note in Monthly Record for September (p. 350).

Dahome. **François.**

Renseignements Colon., Comité l'Afrique Française, Nos. 4 and 5 (1904): 97–103, 132–136.

Le Royaume du Porto-Novo. Par G. François.

Egypt—Historical. **Budge.**

Lady Meux Manuscript No. 6. The Book of Paradise; being the Histories and Sayings of the Monks and Ascetics of the Egyptian Desert, by Palladius, Hieronymus, and others. The Syriac Texts, according to the Recension of 'Anân-Îshô of Bêth 'Âbhê, edited with an English translation, by E. A. Wallis Budge. 2 vols. London, 1904. Size 11½ × 7½, pp. lxxviii., 1096, and 768. *Presented by Lady Meux.*

Egypt—Sinai. *Globus* 85 (1904): 249–253. **Schoenfeld.**

Die Halbinsel Sinai, auf Grund eigener Forschung dargestellt von Prof. Dr. E. D. Schoenfeld.

Egyptian Sudan. *J. R. Colonial I.* 35 (1904): 486–513. **FitzGerald.**

The Commercial possibilities of the Sudan. By W. W. A. FitzGerald.

Egyptian Sudan. *B.S. Khédiv. G.* 6 (1904): 171–183. **Tappi.**

De pays des Chillouks. Par le R. P. Tappi. *With Map.*

Eritrea. *B.S.G. Italiana* 5 (1904): 352–377. **Tancredi.**

Chenafenà. Note del A. M. Tancredi. *With Sketch-maps and Diagram.*

German East Africa. **Koert.**

Berichte Land- u. Forstwirtschaft Deutsch-Ostafrika 2 (1904): 143–164.

Geologisch-agronomische Untersuchung der Umgegend von Amani in Ostusambara. Von Dr. W. Koert. *With Map.*

German East Africa. *M. Deutsch-Schutzgeb.* 17 (1904): 97–98. **Sprigade.**

Begleitworte zu der Karte der Gebiete am Südlichen Tanganjika- und Rukwa-See. Von P. Sprigade. *With Map. Also separate copy presented by the Author.*

The excellent map, largely based on the surveys of Capt. von Prittwitz u. Gaffron, is on the scale of 1 : 500,000.

German East Africa. **Tornau**

Berichte Land- u. Forstwirtschaft Deutsch-Ostafrika 2 (1904): 128–142.

Die geologischen und hydrographischen Verhältnisse an der Karawanenstrasse Kilwa-Songea, Reisebericht des K. Geologen D. F. Tornau. *With Map and Plate.*

German East Africa—Survey. *M. Deutsch. Schutzgeb.* 17 (1904): 99–106. **Techmer.**
Photogrammetrische Aufnahme in West-Usambara, Deutsch-Ostafrika. Von F. Techmer. *With Illustrations.*

German South-West Africa. *Globus* 85 (1904): 338–341, 348–352. **Gessert.**
Ueber Rentabilität und Baukosten einer Kunene-Ableitung. Von F. Gessert.

On a proposed scheme of diverting the Kunene for irrigation purposes.

German South-West Africa. **Hanemann.**
Wirtschaftliche und politische Verhältnisse in Deutsch-Südwest-Africa. Von Dr. Hanemann. Berlin: Deutscher Kolonial-Verlag (G. Meinecke), 1904: Size 10 × 6½, pp. 62.

Kamerun. *Globus* 85 (1904): 265–269, 333–337. **Bauer.**
Bilder aus dem deutschen Tsadsee-Gebiet. Von F. Bauer. *With Illustrations.*

Kamerun. *G.Z.* 10 (1904): 1–13, 74–86, 121–134, 203–218. **Hutter.**
Landschaftsbilder aus Kamerun. Von Hauptmann a. D. Hutter. *With Illustrations.*

Kamerun. *M. Deutsch. Schutzgeb.* 17 (1904): 87–88. **Moisel.**
Notiz zur Karte des Crossfluss-Gebietes zwischen Nssakpe und Ossidinge. Von M. Moisel. *With Map.*

Madagascar. *C. Rd.* 138 (1904): 1318–1321. **Colin.**
Observations magnétiques à Tananarive. Par le P. Colin.

NORTH AMERICA.

Alaska. **Mendenhall and Schrader.**
The Mineral Resources of the Mount Wrangell District, Alaska. By W. C. Mendenhall and F. C. Schrader. (United States Survey, Professional Paper, No. 15.) Washington, 1903. Size 11½ × 9, pp. 72. *Maps and Illustrations. Presented by the U.S. Geological Survey.*

Alaska. **Putnam.**
Geographic Names in Alaska. Native Names for Localities on St. George Island, Bering Sea. Compiled by G. R. Putnam. (Appendix, No. 7, Coast and Geodetic Survey Report, 1903, pp. 1013–1016.) Washington, 1903.

Alaska. ———
Commercial Alaska, 1867–1903. Area, Population, Production, Railways, Telegraphs, Transportation Routes, and Commerce with the United States and Foreign Commerce. (From the *Summary of Commerce and Finance* for July, 1903.) Size 11½ × 9½, pp. 37–118. *Map.*

Canada. *Globus* 85 (1904): 379–383. **Bach.**
Die Grenze zwischen Britisch-Columbia und dem Kanadischen Yukongebiete. Von R. Bach. *With Map and Illustrations.*

Canada—Bay of Quinte. *J. Geology* 12 (1904): 106–132. **Wilson.**
Cuspate Forelands along the Bay of Quinte. By A. W. G. Wilson. *With Map, Plans, and Illustrations.*

Canada—British Columbia. **Herring.**
In the Pathless West, with Soldiers, Pioneers, Miners, and Savages. By Frances E. Herring. London: T. Fisher Unwin, 1904. Size 8 × 5½, pp. xii. and 240. *Illustrations. Price 6s net. Presented by the Publisher.*

Somewhat discursive sketches of life in the early days of British Columbia.

Canada—British Columbia. ———
Annual Report of the Minister of Mines for the year ending December 31, 1903, being an account of Mining Operations for Gold, Coal, etc., in the Province of British Columbia. Victoria, B.C., 1904. Size 10½ × 7½, pp. 276. *Maps and Illustrations.*

The high figure of the yield for 1901 has not been maintained in the two succeeding years, but 1903 shows a slight excess over 1902.

Canada—Muskoka. **Podmore.**
A Sporting Paradise, with Stories of Adventure in America and the Backwoods of Muskoka. By P. St. Michael Podmore. London: Hutchinson & Co., 1904. Size 8½ × 6, pp. xii. and 274. *Illustrations. Price 7s. 6d. Presented by the Author.*

Newfoundland. *J.R. Colon. I.* **35** (1904): 532–546. **Boyle.**

Newfoundland, the Ancient Colony. By Sir C. Boyle, K.C.M.G.

Newfoundland—Currents. **Dawson.**

The Currents on the South-eastern Coasts of Newfoundland and the amount of indraught into the larger bays on the South Coast. From investigations of the Tidal and Current Survey in the season of 1903. W. Bell Dawson. Published by the Department of Marine and Fisheries, Ottawa, Canada. Ottawa, 1904. Size 10 × 7, pp. 32. *Map and Plates.*

Noticed in the Monthly Record for August.

North America—Historical. **Chittenden.**

The American Fur Trade of the Far West. A History of the Pioneer Trading Posts and Early Fur Companies of the Missouri Valley and the Rocky Mountains and of the Overland Commerce with Santa Fe. By H. M. Chittenden. 3 vols. New York: F. P. Harper, 1902. Size 10 × 6½, pp. xxiv. and 1030. *Map and Illustrations.*

A valuable work, with many bearings on the history of exploration in Western North America.

North America—Meteorology. *Meteorolog. Z.* **21** (1904): 262–273. **Wachenheim.**

Die Temperaturverhältnisse von Nordamerika. Von Dr. F. L. Wachenheim.

North America—Pacific Coast. **Manson.**

Rainfall on the Pacific Coast of North and South America and the Factors of Water Supply in California. By M. Manson. [Reprinted from *Journal of the Association of Engineering Societies*, vol. xxx., No. 3, March, 1903.] Size 9 × 6, pp. 14. *Map and Diagrams.*

CENTRAL AND SOUTH AMERICA.

Brazil and Argentine. ——

Guide for the South American Route. For the information of Tourists and Passengers. Published by the Royal Mail Steam Packet Company, 1904. Size 6 × 5, pp. 112. *Map and Illustrations.*

Brazil and Bolivia—Boundary. *B. American G.S.* **36** (1904): 215–216. ——

New Boundary between Brazil and Bolivia. *With Map.*

Brazil and British Guiana. **Nabuco.**

[Question des Limites du Brésil et de la Guyane Anglaise soumise à l'Arbitrage de S. M. Le Roi d'Italie.] Premier Mémoire (size 11 × 7½), Atlas (size 23 × 16), and Annexes, 5 vols. (size 13½ × 8½); Second Mémoire, 3 vols. (size 11½ × 7½), and Annexes, 3 vols. (size 13½ × 8½); Troisième Mémoire, 4 vols. (size 11 × 7½). Paris: A. Lahure, 1903–04. *Maps. Presented by Sr. Joaquim Nabuco.*

Besides stating the Brazilian case in the recent boundary question, these memoirs contain a detailed examination of the British case, and a reprint of many documents bearing on the question.

Chile. **Patron.**

República de Chile, Oficina de Limites. La Cordillera de los Andes entre las latitudes 30° 40′ i 35° S. Trabajos i estudios de la Segunda Sub-Comision Chilena de Límites con la República Arjentina. Luis Riso Patron, S. Santiago de Chile, 1903. Size 11 × 7½, pp. x. and 258. *Maps and Illustrations. Presented by Sr. Luis Riso Patron.*

The first of a series of publications which are to present the results of the important survey expeditions undertaken in connection with the boundary question. The work to which it refers was done from 1894 onwards.

Chile. *Petermanns M.* **50** (1904): 140–144. **Steffen.**

Der Baker-Fjord in Westpatagonien. Von Dr. H. Steffen. *With Map.*

The map is a bathymetrical one based on surveys by the Chilean gunboat *Magallanes*, 1900.

Cuba. ——

Commercial Cuba in 1903. Area, Population, Production, Transportation Systems, Revenues, Industries, Foreign Commerce, and Recent Tariff and Reciprocity Arrangements. (From the *Summary of Commerce and Finance* for October, 1903.) Size 11½ × 9½, pp. 1147–1278. *Map.*

Intercontinental Railway. ———

Pan-American Railway. Report submitted to the Secretary of State by Charles M. Pepper, Commissioner to carry out the Resolution of the Second International Conference of American States. Washington, 1904. Size 9 × 6, pp. 76. *Map. Presented by the International Bureau of the American Republics.*

Martinique. *Science* 19 (1904): 927-928. **Gilbert.**

The Mechanism of the Mont Pelée Spine. By G. K. Gilbert.

In a later note (*Science*, July 22) the writer explains that this communication is an instance of unconscious plagiarism, the idea having been suggested some months earlier by Dr. Lane (see *ante*, p. 353).

Martinique. *Science* 19 (1904): 800–801. **Heilprin.**

The Nature of the Pelée Tower. By Prof. A. Heilprin.

Martinique. *Science* 20 (1904): 23–24. **Hovey.**

Mont Pelé from October 20, 1903, to May 20, 1904. By Dr. E. O. Hovey.

Nicaragua. *Periodical Accounts, Moravian Missions* 5 (1904): 503–505. **Heath.**

Karawala, a Christian Sumu Settlement. By Rev. G. R. Heath. *With Map and Illustration.*

AUSTRALASIA AND PACIFIC ISLANDS.

Pacific. **Lemire.**

L'Océanie Française. Les Intérêts français dans le Pacifique. Tahiti, Nouvelles-Hébrides, Canal de Panama. Par C. Lemire. Paris: Berger-Levrault & Cie., etc., 1904. Size 9 × 6, pp. 100. *Maps and Illustrations. Price 2fr.*

South Australia. **Maurice.**

South Australia. Extracts from Journals of Explorations by R. T. Maurice. Fowler's Bay to Rawlinson Ranges, and Fowler's Bay to Cambridge Gulf. Adelaide, 1904. Size 13½ × 8½, pp. 40. *Maps and Illustrations. Presented by R. T. Maurice, Esq.*

The journey was described in the *Journal* for June, 1902 (p. 760) and March, 1903 (p. 323).

South Australia—Geology. **Rennie and Higgin.**

T.R.S. South Australia 27 (1903): 205–206.

Notes on Supposed Volcanic Dust from the Northern Territory. By Prof. Rennie and A. J. Higgin.

POLAR REGIONS.

Antarctic. *C. Rd.* 138 (1904): 1447-1450. **Nathorst.**

Sur la flore fossile des régions antarctiques. Note de A. G. Nathorst.

See note in the August number (p. 230).

Antarctic. *Deutsch. G. Blätter* 27 (1904): 1-9. **Penck.**

Antarktika. Von Albrecht Penck.

Antarctic—Fauna. *Z. Ges. Erdk. Berlin* (1904): 362–370. **Vanhöffen.**

Die Tierwelt des Südpolargebiets. Von Prof. Dr. E. Vanhöffen. *With Illustrations.*

Antarctic—History of Exploration. *J. Franklin I.* 157 (1904): 81–88. **Balch.**

Antarctica Addenda. By Edwin Swift Balch. *Map.*

Supplementary to the information collected in the writer's 'Antarctica.'

Antarctic—Swedish Expedition. *Petermanns M.* 50 (1904): 117–121. **Bodman.**

Meteorologische Ergebnisse der Schwedischen Südpolarexpedition. Von O. Bodman.

Arctic. *Norske G.S. Aarbog* 14 (1902–3): 103–118. **Sverdrup.**

Den anden norske polarfoerd. Af Kaptein Otto Sverdrup.

Arctic. *Ann. G.* 13 (1904): 97-112. Zimmermann.

L'océanographie du bassin polaire boréal d'après Fridtjof Nansen. Par M Zimmermann.

Arctic—Ice. **Garde.**
The State of the Ice in the Arctic Seas, 1903. Prepared by V. Garde. (Special print of the Nautical-Meteorological Annual of the Danish Meteorological Institute.) Size 12½ × 9½, pp. xxiv. *Maps.*

The actual facts in 1903 corresponded well, in the main, with the forecast made in 1902 (cf. vol. xxii. p. 218, and p. 355, *ante*).

Arctic—Norwegian Expedition. **Nansen.**
The Norwegian North Polar Expedition, 1893–1896. Scientific Results edited by Fridtjof Nansen. Volume iv. London: Longmans & Co., 1904. Size 12 × 9½, pp. 74, 18, and 232. *Plates. Presented by the Fridtjof Nansen Fund.*

Includes a memoir by Dr. Nansen on the Bathymetrical Features of the North Polar Seas. The other two memoirs are less distinctly geographical.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Measurement of Areas. *P.R.S.* 73 (1904): 292–295. **Edwards.**
A Radial Area-Scale. By R. W. K. Edwards. *With Illustration.*

Primitive Cartography. *Deuts. G. Blätter* 27 (1904): 29–46. **Dröber.**
Kartographie bei den Naturvölkern. Von Dr. W. Dröber.

Surveying. *C. Rd.* 138 (1904): 1309–1312. **Laussedat.**
Sur l'emploi d'images stéréoscopiques dans la construction des plans topographiques. Note de A. Laussedat.

Surveying Instrument. *Petermanns M.* 50 (1904): 148–150. **Hammer.**
Der Cyclograph von Ferguson. Von Prof. Dr. E. Hammer. *With Illustration.*

Time. *C. Rd.* 138 (1904): 1657–1659. **Bigourdan.**
Sur la distribution de l'heure à distance, au moyen de la télégraphie électrique sans fil. Note de G. Bigourdan.

Suggests the supply of time to ships on long voyages by means of wireless telegraphy.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Glaciers. *Deutsch. Rundschau G.* 26 (1904): 410–413. **Dürnwirth.**
Von dem Köss. Von R. Dürnwirth.

Köss is an old form of "Kees" (snowfield or glacier), a note on which has been unearthed by the writer from an old manuscript of 1624, written by Martin Strasser, of Kollnitz, Carinthia.

Glaciers. *Ann. Club. Alpin Fr.* 29 (1902–1903): 347–398. **Girardin.**
Commission Française des Glaciers. Rapport sur les Observations Glaciares en Haute-Maurienne, dans les Grandes-Rousses et l'Oisans, dans l'été de 1902. Par M. Paul Girardin. *Illustrations. Also separate copy, presented by the French Glacier Commission.*

Glaciers. *Globus* 85 (1904): 377–379. **Lendenfeld.**
Ueber die Abschmelzung der Gletscher im Winter. Von R. von Lendenfeld.

Hydrology. **Martel.**
L'enfouissement des eaux souterraines. Le reboisement obligatoire. L'exploration hydrologique souterraine des Pyrénées. Communication présentée au Congrès du Sud-Ouest Navigable de Toulouse. Par E. A. Martel. Toulouse; E. Privat, 1904. Size 9½ × 6½, pp. 8. *Presented by the Author.*

Hydrology—Divining-rod. **Heim.**
Vierteljahrs. Naturforsch. Ges. Zürich 48 (1903): 287–306.
Geologische Nachlese, von A. Heim. Nr. 13, Einige Beobachtungen betreffend die "Wunschelrute."

On the use of the divining-rod as a supposed means of discovering springs of water.

Hydrology—Hot Springs. *Geolog. Mag.* 1 (1904): 252–260. **Schwarz.**
Hot Springs. By E. H. L. Schwarz. *With Section.*

Icebergs. *Nautical Mag.* 73 (1904): 354–367. **Allingham.**
Northern and Southern Ice. By W. Allingham.

Limnology—Instrument. *Petermanns M.* **50** (1904): 129. **Halbfass.**

Eine bemerkenswerte Verbesserung des Sarasinschen Limnimètre enregistreur portatif. Von W. Halbfass.

Describes an improvement of the Sarasin instrument for registering fluctuations of lake-levels, devised by Lieut. Schnitzlein of Munich.

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Climate and History. ——

Climate and History. The Physical Causes of the Migration of Civilization. London, [not dated]. Size 8½ × 5½, pp. 16.

Discusses probable changes of climate within historic times, and their effect on human history.

Commercial Geography. *Deuts. G. Blätter* **27** (1904): 10–28. **Eckert.**

Wesen und Aufgaben der Wirthschafts- und Verkehrsgeographie. Von Max Eckert.

Historical. *B. American G.S.* **36** (1904): 193–215. **Stevenson.**

Martin Waldseemüller and the Early Lusitano-Germanic Cartography of the New World. By E. L. Stevenson.

Historical—Benjamin of Tudela. **Grünhut and Adler.**

Die Reisebeschreibungen des R. Benjamin von Tudela nach drei Handschriften, aus dem 13. und 14. Jahrhundert stammend, und ältern Druckwerken ediert und übersetzt, mit Anmerkungen und Einleitung versehen von Dr. L. Grünhut und M. N. Adler. I. Teil. Hebräischen Text. II. Teil. Einleitung, Uebersetzung und Register. Frankfurt a. M., 1903–4. Size 8 × 5, pp. (part 1) 164, (part 2) 28; and 102. *Maps. Price* 2.50*m. each part.*

Historical—Early Travel. **Joubert.**

B.S.G. Lisboa **21** (1903): 393–399; **22** (1904): 5–10.

François le Gouz de la Boullaye, Gentilhomme angevin dit le "Voyageur Catholique" (1610–1669). Por J. Joubert.

Historical—Tabrobane. *J.R. Asiatic S.* (1904): 539–541. **Ferguson.**

The "Taprobane" of Pliny and Ptolemy. By Donald Ferguson.

The writer regards the Taprobanian embassy of Pliny as perhaps mythical, certainly not sent from Ceylon, and considers that Ptolemy's Taprobane was probably Sumatra.

History of Geography. **Günther.**

Geschichte der Erdkunde. Von Dr. S. Günther. (Die Erdkunde . . . herausgegeben von M. Klar, I. Teil.) Liepzig und Wien: F. Deuticke, 1904. Size 10½ × 7, pp. xii. and 344.

BIOGRAPHY.

Grandidier. *Deutsch. Rundschau G.* **26** (1904): 373–375. **Miessler.**

Guillaume Grandidier. Par A. Miessler. *With Portrait.*

Tippu Tip. **Brode.**

M. Seminars Orient. Sprachen Berlin **5** (1902): 3 Abt. 175–277; **6** (1903): 3 Abt. 1–55.

Autobiographie des Arabers Schech Hamed bin Muhammed el Murjebi, genannt Tippu Tip. Transscribirt und übersetzt von Dr. H. Brode.

An interesting sketch of the career of the famous Arab adventurer.

GENERAL.

Bibliography—De Bry's Voyages. ——

Catalogue of the De Bry Collection of Voyages, in the New York Library. (Reprinted from the *Bulletin* of the New York Public Library, May, 1904.) Size 10½ + 7½, pp. 14.

Dutch Language. **Thimm.**

Dutch Self-taught. With Phonetic Pronunciation. By Captain C. A. Thimm. London: E. Marlborough & Co., 1904. Size 7½ × 5, pp. 120. *Price* 2*s*. 6*d*. *Presented by the Publishers.*

Includes vocabularies, a brief outline of the grammar, and various idiomatic phases and sentences likely to be of use to travellers.

Educational—Excursions. *G. Teacher* 2 (1904): 153–158. **Lomas.**
Excursions and the Teaching of Geography. By J. Lomas. *Illustrations.*

French Colonies. ——
Ministère des Colonies, Office Colonial. Statistiques Coloniales pour l'anneé 1902. Commerce. Melun, 1904. Size 9½ × 6½, pp. xx. and 1024. *Presented by the French Government.*

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

England and Wales. **Ordnance Survey.**

Ordnance Survey of England and Wales:—Sheets published by the Director-General of the Ordnance Survey, Southampton, from August 1 to 31, 1904.

4 miles to 1 inch:—

East of England Manœuvre Map, 1904, with boundary printed in colour; folded in cover or flat in sheets, 1*s*.

2 miles to 1 inch:—

With hills and printed in colours, 9, 50; folded in cover or flat in sheets, 1*s*. *each*. East of England Manœuvre Map, 1904, printed in colours, mounted on linen, encased, 2*s*.; on paper, encased, 1*s*. 6*d*.

1-inch:—

(Third edition) in outline, 225, 270, 1*s*. *each* (engraved).
(Third edition) printed in colours, 268, 269, 286, 330, 1*s*. *each*.

6-inch—County Maps (first revision):—

Leicestershire, 31 N.W., 37 S.E. **Shropshire**, 69 S.E. **Somersetshire**, 3 S.W., 17 S.E., 20 S.W., 23 S.E., 27 S.W., 35 (N.W. and N.E.), 38 N.W., 42 N.W., 43 N.W., 66 N.W. **Staffordshire**, 69 N.W. **Suffolk**, 80 N.E., 81 N.E., 82 S.E., 83 N.E. **Warwickshire**, 8 N.W. 1*s*. *each*.

25-inch—County Maps (first revision):—

Brecknockshire, XV. 6; XVI. 9, 10, 13, 14; XXI. 6, 7, 8, 10, 11, 12, 14, 15, 16; XXII. 1, 5, 9, 13; XXIII. 13; XXVII. 7, 8; XXX. 13; XXXIII. 7, 11; XXXIV. 1, 5, 9, 14, 15, 16; XXXV. 4, 8, 12, 13, 14, 15, 16; XXXVI. 2, 5, 6, 11, 13, 14, 15; XL. 3, 4, 5, 6, 7, 8, 10, 11, 12, 14; XLII. 1, 2, 5, 6, 9, 10. **Devonshire**, III. 12, 16; VI. 7; VII. 4, 10, 13; IX. 9, 10, 11, 12, 14, 15; XI. 1; XII. 10, 14; XIV. 2, 5, 6, 13; XV. 14; XXI. 1, 2, 5, 6; XXII. 3, 9, 10, 11, 12, 13, 16. **Leicestershire**, III. 1, 5, 9, 13; VI. 8, 12; VIII. 5, 9, 10, 13, 14; XLVII. 6, 9, 10, 13. **Lincolnshire**, CXIII. 1, 5, 9, 13; CXXII. 1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 12, 14, 15, 16; CXL. 1, 10, 11, 12; CXLI. 2, 3, 7, 9, 10, 11, 12, 13, 14, 15, 16; CXLII. 14; CXLVII. 4, 6, 7, 9, 13, 14, 15; CXLVIII. 2, 3, 4, 11, 13, 14, 15, 16; CLI. 4, 6, 7, 8; CLII. 1, 3, 4, 7. **Rutland**, XIII. 12, 16; XIV. 5, 7, 9, 10; XV. 3, 6, 7, 10. **Somersetshire**, VI. 4. **Staffordshire**, LXVIII. 16; LXIX. 13; LXXII. 3, 4, 7, 11. **Suffolk**, XXXI. 8, 12, 16; XXXII. 9, 10, 13; XXXIII. 7, 8, 9, 10, 12, 13, 14, 16; XXXIV. 5, 6, 9, 10, 11, 12, 13, 14, 15, 16; XXXV. 5, 6, 8, 9, 11, 12, 13, 14, 16; XXXVI. 6, 7, 8, 9, 10, 11, 12, 14, 16; XXXVII. 6, 14; XLII. 3, 4, 7, 8, 12; XLIII. 9, 13; XLIV. 7; XLV. 1, 8; XLVI. 1, 4; XLVII. 4; XLVIII. 1, 2, 3, 4, 16; XLIX. 13; L. 10, 12, 14, 15; LIX. 4; LX. 2, 3. **Warwickshire**, VII. 16; VIII. 13; IX. 13; XIII. 3, 4, 7, 11; XX. 9. **Worcestershire**, V. 7, 11; VII. 4, 8, 15; XVI. 12; XXVIII. 15; XXXIII. 7, 13, 14, 15, 16; XXXIV. 13; XL. 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12; XLI. 1, 5, 9. 3*s*. *each*.

(*E. Stanford, London Agent.*)

Germany. **Königl. Preuss. Landes-Aufnahme.**

Karte des Deutschen Reiches. Scale 1:100,000 or 1·6 stat. mile to an inch. Sheet 314, Magdeburg. Herausgegeben von der Kartogr. Abtheilung der Königl. Preuss. Landes-Aufnahme, 1904. *Price* 1.50 *mark each sheet.*

ASIA.

Asia. **Service Géographique de l'Armée, Paris.**

Asie. Scale, 1: 1,000,000 or 15·8 stat. miles to an inch. Sheets: 36 N. 108 E., Si-ngan Fou; 40 N. 108 E., Ning-hia Fou; 48 N. 126 E., Kharbin. Paris: Service Géographique de l'Armée, 1904.

China. **Königl. Preuss. Landes-Aufnahme.**

Karte von Ost-China. Scale 1 : 1,000,000 or 15·8 stat. miles to an inch. Sheet: Dolon nor. Kartographische Abtheilung der Königl. Preuss. Landes-Aufnahme, 1904. *Price* 1.50 *mark each sheet.*

This sheet includes the part of Mongolia lying between 42° and 46° N. lat. and 112° and 118° E. long., and contains information concerning the character of the country, caravan routes, etc. It is, however, to be regretted that the route survey of Mr. C. W. Campbell, who passed through the region shown on the eastern part of the sheet, and which is laid down on a large scale map in the *Geographical Journal* for November last, has not been taken full advantage of. Mr. Campbell has had considerable experience at route surveying, and his work gives fresh information concerning the country traversed, besides correcting the positions of places which were formerly laid down with the roughest approximation.

Manchuria. **Service Géographique de l'Armée, Paris.**

Théâtre des Opérations en Mandchourie. Scale 1: 1,000,000 or 15·8 stat. miles to an inch. Paris: Service Géographique de l'Armée, 1904.

This map is based upon the French 1: 1,000,000 Carte de l'Asie, published by the Service Géographique de l'Armée. Fresh information has been added, and many place-names appear which were not given before.

AFRICA.

Africa. **Intelligence Division, War Office.**

Africa. Scale 1 : 250,000 or 3·9 stat. miles to an inch. Northern Nigeria (Provisional). Sheets: 62—C, G, H, K, L, O, P. London: Intelligence Division, War Office, 1904. *Price* 1*s.* 6*d. each sheet. Presented by the Director of Military Operations.*

Comoro Islands. **Meunier.**

Carte des Iles Comores, dressée par A. Meunier, 1903. Paris: Service Géographique et des Missions.

Seven plans of the Comoro Islands, on one sheet, based upon the surveys and sketches of Captain Dubois, MM. Coste, Le Houx, and other officers of the French navy. Heights are given by contour lines and figures, but no soundings round the coast are laid down. These would have added considerably to the interest of the plans, and rendered them far more instructive.

Egypt. **Egyptian Survey Department.**

Topographical Map of Gharbia Province. Scale 1 : 10,000 or 0·15 stat. mile to an inch. Sheets: N.W. 37—3 and 38—2. Provisional Map of Assiut Province. Scale 1 : 50,000 or 0·78 stat. mile to an inch. Cairo: Survey Department, 1904. *Presented by the Director-General, Survey Department, Cairo.*

Egypt. **Grünau and Steindorff.**

Karte der Leipziger Expedition in die Libysche Wüste, November, 1899, bis Januar, 1900. Nach Aufzeichnungen Freih. C. v. Grünau's u. Prof. Dr. Steindorff's. Scale 1 : 1,300,000 or 20·4 stat. miles to an inch. *Petermanns Geographische Mitteilungen,* Jahrgang 1904, Tafel 12. Gotha: Justus Perthes, 1904. *Presented by the Publisher.*

German East Africa. **Sprigade and Moisel.**

Karte von Deutsch-Ostafrika. Begonnen unter Leitung von Dr. Richard Kiepert, fortgesetzt unter Leitung von Paul Sprigade und Max Moisel. Scale 1: 300,000 or 4·7 stat. miles to an inch. Sheet G 4 and H 4, Ssongea. Berlin: D. Reimer (Ernst Vohsen). *Presented by Herr Max Moisel.*

South Africa. **Johnston.**

Map of South Africa. Scale 1 : 1,520,640 or 24 stat. miles to an inch. London and Edinburgh: W. and A. K. Johnston, 1904. 2 sheets. *Presented by the Publishers.*

A new edition of a wall map of South Africa. The physical features are not well brought out, and such indication of mountain ranges and relief as exist is to a great extent obliterated by the unnecessarily heavy colouring used to show the political divisions.

Witwatersrand Goldfields. **Flowers.**

Standard Map of the Witwatersrand Goldfields, compiled at the "Map Office," Johannesburg, by Frank Flowers, C.E. Scale 1 : 40,000 or 0·6 stat. mile to an inch. Johannesburg: The Argus Printing and Publishing Company, 1904. *Presented by Frank Flowers, Esq.*

Although this map is called a new edition in the prospectus which accompanies it, it is practically a new compilation, containing fuller information than that given on the map published five years ago by Messrs. Wood and Ortlepp, with corrections and additions to bring it up to date. The scale is now 1 : 40,000, which is slightly smaller than that of the earlier map. Several inset plans have been added.

AMERICA.

Argentine Republic. **Rohde.**

Mapa General de la Republica Argentina y de los Paises Limitrofes. Scale 1 : 2,500,000 or 39·4 stat. miles to an inch. 4 sheets. Publicado bajo los auspicios del Instituto Geografico Argentino por el Coronel Don Jorge J. Rohde. Buenos Aires, 1903.

A new edition of a map of Argentina which first appeared in 1896. Much new survey work, including that of the Chilian and Argentine boundary commissioners, has been done since that date, and this is now shown in red, together with the new boundary line, railways, &c. The execution of the map is rough and somewhat confused, but it contains useful information.

Bolivia. **Jerrmann.**

Reise in Ost-Bolivien, 1898, von Kapitän Ludwig Jerrmann. Scale 1 : 3,000,000 or 47·3 stat. miles to an inch. *Petermanns Geographische Mitteilungen*, Jahrgang 1904, Tafel 13. Gotha: Justus Perthes, 1904. *Presented by the Publisher.*

Brazil. **Posnansky.**

Mapa del Rio Acre. Scale 1 : 210,000 or 3·3 stat. miles to an inch. Por el Ingeniero Arturo Posnansky, año 1897 á 1900. La Paz: Oficina Nacional de Inmigración Estadistica. *Presented by the Oficina Nacional de Inmigración Estadistica.*

Canada. **Department of the Interior, Canada.**

Map showing Mounted Police stations in North-Western Canada, 1904. Scale 1 : 2,217,600 or 35 stat. miles to an inch. 2 sheets. Map showing Mounted Police stations in the North-West Territories, 1904. Scale 1 : 792,000 or 12·5 stat. miles to an inch. 2 sheets. Ottawa: Department of the Interior. *Presented by James White, Esq., Geographer, Department of the Interior, Canada.*

The Mounted Police stations are shown on these maps by flags which are in red, together with the names, and tables are given of the distances between them. Indian Reserves are also shown, as well as railway and telegraph lines. Apart from the special purpose for which the maps have been published, they contain a great deal of general information.

Canada. **Department of the Interior, Canada.**

Railways in Manitoba, Assiniboia, Alberta, and Saskatchewan, 1904. Scale 1 : 2,217,600 or 35 stat. miles to an inch. Ottawa: Department of the Interior. *Presented by James White, Esq., Geographer, Department of the Interior, Canada.*

The progress of railway development in Western Canada is clearly shown on this map. The railways opened are indicated by a thick black line, and those under construction by a broken black line. The rapid progress in railway extension to the north of the Canadian Pacific main line is seen at a glance at this map.

Canada. **Department of the Interior, Canada.**

Standard Topographical Map. Scale 1 : 250,000 or 3·9 stat. miles to an inch. Ontario, Windsor Sheet 1 S.W., Essex, Kent, and Lambton, and portions of Elgin, Middlesex, and Huron counties. Ottawa: Department of the Interior, 1904. *Presented by James White, Esq., Geographer, Department of the Interior, Canada.*

Canada. **Surveyor-General's Office, Ottawa.**

Sectional Map of Canada. Scale 1 : 190,080 or 3 stat. miles to an inch. Red-Deer sheet 77, West of Fourth Meridan, revised to July 5, 1904. Ottawa: Surveyor-General's Office, 1904. *Presented by the Surveyor-General of Canada.*

La Paz. **Oficina Nacional de Inmigración Estadistica, La Paz.**

Plano de la Ciudad de La Paz. Lavantado por la Comision Topografica, 1902. Scale 1:4000 or 15·8 inches to one mile. Ensanche de la Ciudad de La Paz, 1903. Scale 1:1000 or 63·36 inches to one mile. La Paz: Oficina Nacional de Inmigración Estadistica. *Presented by the Oficina Nacional de Inmigración Estadistica.*

Uruguay. **Gonzalez.**

Carta Geografica de la Republica Oriental del Uruguay. Scale 1:500,000 or 7·9 stat. miles to an inch. 4 sheets. Construida por Melitón Gonzalez. Editada bajo los auspicios del Ministerio de Fomento, 1900.

GENERAL.

World. **Hartleben.**

A. Hartleben's Volks-Atlas enthaltend 72 Karten in Einhundert Kartenseiten. Vierte-Auflage. Lieferung 11–13. Vienna and Leipzig: A. Hartleben, [1904]. *Price 50pf. each part.*

World. **Stieler.**

Neue, neunte Lieferungs-Ausgabe von Stielers Hand-Atlas, 100 Karten in Kupferstich, 33 and 34 Lieferung. Gotha: Justus Perthes, *Price 60pf. each part.*

Parts 33 and 34 are in one cover, and contain maps Nos. 9 and 10, two sheets (Nos. 1 and 2) of the map of the German Empire on the scale of 1:1,500,000, and Nos. 19 and 20, forming sheets Nos. 3 and 4 of the map of Austria Hungary on the scale of 1:1,500,000. All of these are from the drawings of C. Vogel, and are new and revised editions.

CHARTS.

North Atlantic and Mediterranean. **Meteorological Office.**

Pilot Chart of the North Atlantic and Mediterranean for September, 1904. London: Meteorological Office. *Price 6d. Presented by the Meteorological Office, London.*

United States Charts. **United States Hydrographic Office.**

Pilot Charts of the North Atlantic Ocean for August, and of the North Pacific Ocean for September, 1904. Washington: U.S. Hydrographic Office, 1904. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

Upper Nile. **Wilson.**

Sixty-two photographs of the Upper Nile and its environs, taken by Captain H. H. Wilson. *Presented by Captain H. H. Wilson.*

Captain Wilson has had exceptional opportunities of becoming acquainted with the Upper Nile region above Fashoda, having spent some years there, occupied with surveying and other duties in the service of the Government. These photographs were taken by him during the years 1900 and 1901, and those of the Galla country between Goré and Itang are specially interesting. He has just started again for the region, and doubtless will be able to add still further to the series of photographs he has already taken. The titles are as follows:—

(1) The Negadros Burro and wife at Goré; (2) Ras Tesemma Nado in his "diplomatic" dress; (3) Ras Tesemma Nado, Governor of Goré; (4 and 5) Ras Tesemma Nado and gun-bearers; (6–9) Abyssinian soldiery; (10) Purchasing mules and cows in Abyssinia; (11) Bridge over river in Abiv district of Goré; (12) Ato Melka and the Negadros Burro; (13) The Kainyasmach Duballa; (14) Typical view near Bure; (15) Distant view of Goré mountain; (16) The Baro Gorge; (17) Cattle market at Bure; (18) Purchasing cows at Bure; (19) Towing a boat up the Baro river near Kano; (20) Base camp at eastern mouth of Adura river; (21) Boat drifting down Baro river; (22) View on Baro river; (23) "Faidherbe" island on Baro river; (24) View on Baro river; (25 and 26) Abwong, on Sobat river; (27) The Zaptia, or police-station at Abwong; (28) Camp on the Sobat river; (29) Garden at Abwong; (30) Fawel, on Sobat river; (31) Village on Sobat river; (32) Anyuaks at Itang, on Baro river; (33) Anyuaks at Fatiwanyang, on Sobat river; (34) Paying Anyuaks for cutting fuel for steamer at Yakwoik; (35) Purchasing ivory from Dinkas at Khor Atar; (36) Dinka women at Dunjol; (37) Dinka cattle in Dunjol; (38) Dinka skeikhs at Bor; (39) Dinka skeikhs and followers at Demtemma; (40) Dinka village

in Dunjol; (41) Dinka cattle at Fanathiang; (42) Patrol halting in Dinka village in Dunjol; (43) Steel boat on Khor Adar, near junction with White Nile; (44) Camp on Khor Adar, near White Nile; (45) Three Dinka and one Arab skeikh at Renk; (46) Shilluks at Kaka, on White Nile; (47) Police officer's house at Demtemma; (48) Old French garden at Kodok; (49) Fording Khor Rao, near Jebel Ahmed Aga; (50) Kinana Arabs bringing in dura on bullocks for sale at Kodok; (51) View of Jebel Lado, from Mongalla; (52) Melut; (53) Garden at Renk, on White Nile; (54) The "Gordon Pasha" at Renk; (55) "Tawfs," or floating-grass islands on White Nile near Kodok; (56) Inspector's house at Mongalla; (57) Banana plantation at Kodok; (58) Floating timber down Blue Nile at Khartum; (59) Nuers on Baro river; (60) Nuers from Bahr-el-Zeraf, on a visit to the governor of Kodok: (61) Steel boat in reeds on White Nile at Melut; (62) Nuer cattle on Bahr-el-Zeraf.

Sarawak. **Sternberg.**

Ninety-one Photographs of Sarawak, taken by F. R. Sternberg, Esq. *Presented by F. R. Sternberg, Esq.*

As will be gathered from the titles, these are most interesting photographs, specially from an anthropological point of view. Those showing the tattoo markings of the Kayans are perhaps unique:—

(1) The palace from Kuching; (2) Side view of palace; (3) The park at back of palace; (4) Drawing-room in palace; (5) The Rangers, men of H.H. the Rajah's army; (6) Band of Rangers playing in the palace grounds; (7) A Ranger in mufti; (8) Rangers in gala costume; (9) Rangers, showing filed teeth with brass springs inserted; (10) A Ranger's wife; (11) A Ranger's wife, showing head ornament invented by a former Resident; (12) The fort and surroundings adjacent to palace; (13) Kuching from palace grounds; (14) Government buildings, Kuching; (15) The Datu Hak Kun, Malay official; (16) Principal business street, Kuching; (17) Band stand, Kuching; (18) Museum, Kuching; (19) Police-station, Kuching; (20) Chinese theatre, Kuching; (21) A Dyak in the Main Road, Kuching; (22) Chinese procession, Kuching; (23) View of Kuching and the river, the Rajah's yacht in mid-stream; (24) Village at mouth of Rajang river; (25) Government buildings, Bau; (26) Court House, Bau; (27) Native football players, Bau; (28) Principal street, Bau; (29–31) Malay houses on road to river, Bau; (32) Gold works, Bidi; (33) Mr. Sternberg's Malay servant; (34) Sarawak Government steamer *Kaka;* (35) H.H. the Rajah Muda interviewing Dyak chiefs at the Residency, Sibu; (36) A group of Dyak head-hunters, who have been fined, and have submitted to Government; (37) Football at Sibu; (38) Golf caddies, Sibu; (39) Front view of a Dyak chief; (40) Back view of a Dyak chief; (41) Three Kayans; (42) Kayan, showing ear ornament; (43) Heads taken by Government from head-hunters; (44) The largest war canoe ever seen in Sarawak; (45) Government boat in which Mr. Sternberg visited Dyak house; (46) Dyak house; (47) Dyak house seen from below; (48) Entrance to Dyak house; (49) The inside balcony; (50) Door of room in Dyak house; (51) Skulls in Dyak house; (52) Women inhabitants, Dyak house; (53) Women and girls, Dyak house; (54) Mr. Sternberg and Dyak women; (55) Dyak children; (56) Melanau house in jungle; (57) Melanau girl; (58) Melanau youth playing nose flute; (59) Fort Kenowit on Rajang river; (60) Government steam-launch *La Fé;* (61) H.H. the Rajah Muda and bull-dog; (62) Taking passengers on the launch; (63) A Dyak hostage; (64) Hostage being paddled ashore; (65) A Moloh house, Rajang river; (66) Dyak women married to a Moloh; (67) Moloh children; (68) Fort Kapit, Rajang river; (69) Grounds and lake at Fort Kapit; (70) H.H. the Rajah Muda holding conference with Dyaks at Fort Kapit; (71) Jars taken from head-hunters; (72) Gongs taken from head-hunters; (73) H.H. the Rajah Muda conversing with Dyaks; (74) A group of Dyaks at Fort Kapit; (75) Dyak blowing dart from blow-pipe, Fort Kapit; (76 and 77) A Ukit covered back and front with tattoo marks; (78) Dyak woman and child; (79–83) Tuba fishing; (84) Chinese leaders of rebellion in 1899; (85) Chinese village on Sarawak river; (86) Kayan woman's hand and forearm, showing tattoo marks; (87–91) A complete set of the tattoo marks of the Kayans.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

ARGENTINE REPUBLIC

O'DRISCOLL

canoemen have to resort to the tedious process of forcing their craft up-stream by catching and hauling on the overhanging branches. At others, and more particularly above Bussa, where large beds of reeds border the channel, and the water is too deep for poling, cross-pieces of stick about a foot long are lashed to the end of the bamboos, and thus a purchase is obtained on the reeds. This operation disturbs countless mosquitoes, who are not slow in giving expression to their resentment. Paddles are used in the deeper part of the river, particularly when, as is often the case, it is desirable to cross to get into a favourable stretch for poling.

FOREST SCENERY, LOWER NIGER.

All the river-side people, and particularly the Nupes, are expert canoemen. They commence poling at a very early age. Their skill is most conspicuous where the stream runs wildly amongst boulders or over sunken snags. Only one of the Boundary Commission canoes was upset, and this was in some rapids above Bajibo. All the contents were successfully fished out of the river, with the exception of one bale of cloth. A long canoe journey up-stream is to be avoided if possible. Sitting all day under a mat shelter in a narrow dug-out gets wearisome long before the three weeks' journey from Jebba to the frontier is accomplished. If steel canoes, such as the French use in their journeys with the Niger flotilla, are forthcoming, the discomforts are considerably lessened, the more so as it is possible to sleep on board and avoid camping, often on swamps alive with mosquitoes. The dug-outs, too, are more or less leaky, and some care has to be exercised to prevent the loads

placed in them being damaged. Above Jebba rapids are frequent, but they are negotiable by the skilled Nupe canoemen, till the Wurroo rapids are reached. Between this spot and Bussa there are a series of rapids, of which three are formidable. It is advisable, in fact necessary, to unload the canoes and send the loads round by land, whilst the canoes are hauled up empty.

It was in one of these rapids that the dauntless Mungo Park met his death, when he appeared to be, after braving countless difficulties and dangers, on the point of solving the mystery of the Niger's course.

After surmounting the big rapids near Bussa, the river was still full of smaller ones that gave more or less trouble till, a few miles above Yelwa, a quieter section of the river was entered, and the journey to the frontier was accomplished without further difficulty.

Dole, near which village is the westernmost end of the boundary, lies a little way back from the Niger, on its left or eastern bank up a marsh-fringed creek. Marshes border the river for a mile or so in depth, and clumps of fan palms indicate spots where the ground is more solid. These trees are plentiful on the land side of the marshes and for some way up the Dallul Mauri.

Dallul Mauri, or the valley of the Mauris, the people of Arewa, is the name applied in the Convention to a depression that can be traced with more or less distinctness from near Matankari down to its junction with the Niger, the Dole creek being its mouth. It was once, I consider, a river valley, but no river or stream now flows along it, except perhaps during the rains there may be a current from marsh to marsh in the lower part of its course

JUNCTION OF RIVER NIGER WITH DELTA.

The
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THE ANGLO-FRENCH NIGER-CHAD BOUNDARY COMMISSION.*

By Lieut.-Colonel G. S. McD. ELLIOT, R.E.

The work of the Boundary Commission that left England in October, 1902, was to ascertain on the spot where the frontier between the river Niger and Lake Chad, defined in the Anglo-French Convention of 1898, actually lay. The country through which this frontier passes was little known at the time of the signature of the Convention, so the delegates were forced to content themselves by defining it for the greater part in geometrical terms. Briefly it was this: Starting from the Niger 10 miles above Giris, it was to follow the median line of the depression known as the Dallul Mauri till this line intersected an arc of 100 miles' radius, with the town of Sokoto as centre. From this intersection point the arc itself was the boundary for about 300 miles, till to the north-east of Sokoto it cut for the second time the parallel of 14° N. lat. This parallel was to be followed for the next 70 miles, and then the meridian of longitude thus arrived at down to its meeting with the parallel of 13° 20′ N. lat., along which the frontier was to run for 250 miles, next a meridian of longitude from this point was to be followed north till the 14° N. was regained, and this again became the frontier till it intersected a third meridian of longitude lying out in Lake Chad, 35′ east of the centre of the town of Kukawa. This third meridian from this intersection point till it reached the southern shore of Lake Chad formed the last section of the boundary.

The line thus traced, though crossed in various parts, had not been followed for any distance by previous travellers. Denham, Clapperton, Oudney, Barth, Monteil, and others had between them visited Kuka,

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* Read at the Royal Geographical Society, June 27, 1904. Map, p. 616.

Kano, Katsena, Sokoto, and Zinder; but the line of the frontier now under consideration, lying as it did in an uninteresting and sparsely inhabited country at the edge of the desert, was, naturally enough, not visited when so much that was interesting and important was little if at all known.

In 1900, Major Lang-Hyde, C.M.G., of the Royal Engineers, had surveyed the Dallul Mauri to some distance beyond its intersection with the arc of 100 miles' radius round Sokoto, and had put beyond question where and what the Dallul Mauri was. Captain Merrick, of the Royal Artillery, who was in command of the Argungu column in 1902, had with his officers made useful reconnaissance sketches round the arc and beyond as far as Maradi. Captain Mundy, Assistant-Resident, had done the same for a portion of West Bornu.

A boat from Liverpool takes the traveller to the Forcados mouth of the Niger, where at Burutu a stern-wheel river-steamer is in waiting to carry him up the river. For about 100 miles the way lies through the delta, a region of swamps, creeks, and dense forests, among which, after passing through the last of the rocky barriers that separate the coast-belt from the interior, are distributed the waters of the Niger and the Benue. Near the sea the mangrove is the most striking of the creek vegetation. Farther up palms, most important of which is the one whose nuts furnish the palm oil of commerce, are more conspicuous as the land becomes firmer. Villages, whose inhabitants are expert canoeists, are passed more frequently, and occasionally a trading-station. Crocodiles are plentiful everywhere, and sometimes a herd of hippo, creatures most thoroughly in keeping with their surroundings, is seen, their heads appearing and disappearing at intervals. Just before the ascending steamer enters the channel of the Niger, which discharges itself near Akassa, the Forcados river narrows considerably, and this main channel is gained by a sharp right-angle turn. All up the river the forest grows right up to the edge of the banks, and as these are continually being cut away, the trees on them fall into the water, and are carried down till they take the ground in some shallow spot and alter the set of the current, causing silt in one place and scour in another, thus adding to the difficulties of navigation. Lokoja, opposite the confluence of the Niger and Benue, may be considered the port of entry of Northern Nigeria. It was here we enjoyed the hospitality of the 2nd Northern Nigeria Regiment, and made the acquaintance of some of the troops who were destined to take part in the Kano-Sokoto campaign.

For most months in the year steamers can go between Lokoja and Jebba, the former headquarters of Northern Nigeria, another 200 miles up the river. At Jebba one must take to the native canoes. These are hollowed-out logs, propelled by poles made out of the central stems of palm leaves, which are called "bamboos" in Northern Nigeria. In places where the current runs swift and deep under a woody bank, the canoemen have to resort to the tedious process of forcing their craft up-stream by catching and hauling on the overhanging branches. At others, and more particularly above Bussa, where large beds of reeds border the channel, and the water is too deep for poling, cross-pieces of stick about a foot long are lashed to the end of the bamboos, and thus a purchase is obtained on the reeds. This operation disturbs countless mosquitoes, who are not slow in giving expression to their resentment. Paddles are used in the deeper part of the river, particularly when, as is often the case, it is desirable to cross to get into a favourable stretch for poling.

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JUNCTION OF RIVER NIGER WITH DELTA.

The term "Dallul Mauri" is only correct for the portion of the depression that lies in the Mauri country, from near Nasserawa on the north to Goru on the south. The lower portion of its course from the Niger up to its bifurcation opposite to the village of Banna is called Rafin Foga, or the Valley of Salt. This name of Rafin Foga is retained, and properly so, by the more western branch that lies in French territory, for the salt marshes to which it is due do not extend up the so-called Dallul Mauri beyond this junction point.

LAKE CHAD.

Leaving the Dole creek and following the valley, which must henceforward for its whole length bear the name of Dallul Mauri, we come on a grassy valley with fan palms in abundance, at first several miles in width, but gradually narrowing as we ascend. A series of depressions — the beds of marshes, dry at the time of our visits in December and January, but along which in the rains a stream doubtless flows—mark what appeared to be "the median line." On either hand bush-covered laterite scarps, more or less interrupted by side valleys, define the borders. Farther up, above the junction with the Rafin Foga, these scarps disappear on the left or west side; gently rising rolling ground, which recedes considerably as the valley widens again above Yelu, takes their place, whilst on the right, though in places hard to trace owing to bush-covered under features, they are fairly continuous up to Nasserawa. Here there is a break of some 25 miles, after which they reappear at Budu, and, passing Matankari, trend away eastward and disappear.

The cross-section of the upper portion of the depression appears to be that of a line of fault, the eastern side being the upthrow, and the western the downthrow. From the junction of the Rafin Foga down to the Niger, the valley may have been formed by the action of water, possibly that of the Rafin Foga, but more probably there was a double fault, forming a rift-valley similar to those in East Africa. At the junction of the Rafin Foga and Dallul Mauri, and for some miles below, the water had not dried out of the marshes, and it was there that the salt villages were most numerous. Above the junction-point the bed of the valley was dry in December, the long grass and reeds are scarcer and the bush is thicker. Fan and borassus palms and large forest trees still abound, as well as evidences of the visits of elephants, giraffes, and other game during the rains. Gradually the larger trees give place to smaller varieties and thorn bushes. The shea butter tree becomes scarce after passing Yelu, the palms between Yelu and Junju and the baobab disappear almost entirely before reaching Matankari.

Dry beds of marshes, often long enough to suggest that they form a continuous channel, but really disconnected, are found right up to the arc. The point arose whether the median line of the Dallul Mauri was to be considered to lie along the middle of these marshes or midway

BUSSA RAPIDS.

between the crests of the high ground on each side of the valley—by no means the same thing. Both views presented difficulties, but the natives considered the Dallul to be that part of the depression where the fan palms grew, and these were only to be found where their roots could get moisture, and consequently close to the marshes. The middle line of these was therefore, with a certain amount of give and take, adopted as the median line of the Dallul Mauri.

WOMEN TILLING FIELDS.

Round the arc as far as Illela the country consists of gentle undulations of sand covered with thorny bush. In places scarps rising abruptly mark the edge of laterite plateaux that fall gently away till they blend with the general level of the ground. Occasionally a few outliers from these cliffs form prominent features.

Near Illela are groups of hills of dark, coarsely crystalline rock, I think of volcanic origin, possibly of later date than the laterite and intrusive. Some of these rise to a greater height—about 400 feet above the general level of the country—than any hitherto encountered.

After passing Illela, the arc crosses a series of valleys or rifts in the laterite sheet, which is here much more generally in evidence. These valleys have their origin outside the arc, most of them apparently to the north-east of Tawa, and were doubtless once drained by streams that were affluents of the Sokoto Gulbi, through which their waters reached the Niger.

They are much more pronounced than the Dallul Mauri or any of the depressions met with previously, being usually about one mile wide and 200 feet (or more) deep, and, though possibly in places originating along cracks in the lava-sheet that at one time overspread the country, were, as their cross-section shows, cut down to their present depth by the action of water. Water is often found in them at a little depth below the surface, and the soil is more fertile and vegetation larger and more plentiful than on the laterite crust of the plateau. Like the Dallul Mauri, they do not now appear to be drained continuously throughout their length, for the portion of the rainfall that does not soak into the soil at once, forms pools along their courses.

I noticed the following geological section in one of them between Tawal and Bussa. First, the laterite; second, shale, laminated like pressed tobacco-leaves; third, chalk and clay mixed; fourth, chalk; fifth, shales. The strata were horizontal. In places, doubtless owing to denudation, the upper shales had been removed, and the laterite lay on the chalk, which was more or less baked and hardened in consequence. The chalk was full of echinoids and other fossils. Wherever, in this neighbourhood, I saw strata exposed, this section seemed to prevail. Probably it goes as far south as Sokoto or further, for the resident there, Major Burdon, showed me a piece of indurated chalk which he had found in a watercourse to the east of the city.

CARRIERS DRINKING AT RAIN-WATER PUDDLE.

The laterite plateau terminated near Chara and Bussa in scarps the highest encountered on the border, which trended away eastward and northward into the desert. The Duchin Zana, a large hill which lies a little to the north of the intersection of the arc with the parallel of 14° N. lat., is probably an outlier from the plateau.

It is with considerable diffidence that I put forward any geological theory; in fact, it is only in the hopes of provoking discussion on the subject, and because it enables me to give more clearly the impression produced by what I observed, that I venture to do so.

It appeared to me that the whole region lying along the frontier from the Niger to the bluffs near Bussa and the Duchin Zana, extending to the north as far as Tawa, or even further, and possibly to the south as far as Sokoto, had, some time after the deposition of the shale above the chalk, been covered with a sheet of lava, of which the laterite is now the remains. The portion of this sheet lying east of the line Illela-Tawa must have become subject to subaërial denudation for some long period before the westerly portion, to account for the very much greater depth of the valleys. Probably, therefore, when the lava flowed over the bottom of the shallow waters in which the shales were being deposited, the earth-crust in this region was undergoing a gradual upheaval, the eastern portion rising before and higher than the western. Possibly the mud flats which are now the shales were above water at this time; certainly parts of them were, as is testified by the laterite resting in places on the chalk.

A STREET IN KANO.

Whatever was the case, the climate of that part of Africa must have been very different from what it is now. These deep valleys must, I think, have been hollowed out by the action of water at a time when large lakes and inland seas occupied regions that are now desert. Since these disappeared, the prevailing winds have been spreading the sand that lay in their beds over what was once probably a well-wooded and pleasant land. Thus to-day we see work done in ages long past by water in carving out hills and valleys being undone by wind, which is blocking the valleys and building hills of its own, whilst it removes for the purpose all the loose soil it can gather and bears it steadily south-westward.

The drainage of the country must be chiefly subterranean. Possibly much of it finds its outlet in the marshes bordering the Niger. Though water is still doing something to alter the face of the land, Æolian influences are more in evidence here than in any country I have yet seen. The lee side of every rock, bush, or tuft of grass becomes the starting-point of a sand-dune, the material for which is being carried from more exposed situations; whilst these sand-dunes themselves gradually work down-wind unless and until their surface is consolidated and protected by vegetation. The rainfall is not sufficient to form currents strong enough to break through the obstacles thus piled up across the old lines of drainage, and the water collects in pools and hollows, from which it soon disappears by evaporation and infiltration. The old features shaped by the action of water are thus being obliterated and the country is, in consequence, most difficult to survey rapidly and satisfactorily, for it possesses few striking features, and no general system of surface drainage that may readily be seized on.

The rains commence in June and last till the end of September. Except in August, however, such a thing as a really wet day is rare. Captain Moll, the French Commissioner, told me that in his experience the week in that month in which the moon was full was the rainiest of the year, and it certainly was the case in 1903. Three or four storms a week is about the usual average for the rainy season. About two months after the rains have ceased, *i.e.* the end of November, the Harmattan sets in, and blows steadily from the north-east till April. During this time the air is misty with suspended dust; sometimes, so thick is the haze, the largest objects are invisible at half a mile. Vegetation dries up, and everything gets covered with the finest powder. The temperatures in December and January are from 100° Fahr. by day to 60° Fahr. by night. April is the hottest month; the day temperature reached 114° Fahr. in the shade, and the lowest it fell to at night was 78° Fahr.

During April and May the wind at times blows from other quarters, the air gets clearer, clouds gather, sandstorms get more frequent, till they become a daily institution, and a few drops of rain occasionally raise hopes that are usually disappointed till June is near, and the first real shower is hailed with cries of delight from the people, who are now assured that the seed they have sown will not perish in the ground. The temperature ranges from 113° Fahr. by day to 76° Fahr. by night. Grass and verdure appear everywhere, and all conditions have changed for the better.

MARKET-PLACE, KANO.

Except during the rains and for a short time after, the only water in these regions is in deep wells at the villages. As the bush dries up, the larger animals that have come into them for the sake of the fresh grass take their departure for better-watered spots, but there are a certain number of smaller mammals and birds that live here the whole year through. We noticed oribi, gazelles, wild cats, certain burrowers and rodents, guinea-fowl, francolin, hornbills, bustard, various birds of prey, and many small birds. The problem of how they managed to exist without water appeared a puzzling one. I mentioned this difficulty to some French officers, whom I have always found to be very well informed and careful observers. They drew my attention to the fact that there was, even at the end of the dry season, moisture in the leaves and twigs of certain plants, and, further, that it was probable that the bodies of white ants supplied birds with all the liquid they required. These little creatures cover everything they are going to attack with galleries made out of clay. To moisten this clay they must have water, which they bring from considerable depths. The officer in charge of the well-sinking along the road from Filingi to Tawa told me that white ants had been found 50 metres below the surface in some of the

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that ascends northward from the parallel of 13° 20′ N. to 14° N. passes roughly through the middle of it. Contrary to expectation, this is not a dreary waste of salt-encrusted desert sand, but open plains, sandy certainly, but covered with waving grass about 4 feet high, diversified here and there by lines of borassus palms which mark the course of depressions, where water is usually to be found at a small depth below the surface even if they do not contain pools. When we passed through in November, the grass was all dried up, and the horrible burr called the kram-kram was here, as everywhere we went, plentiful. When green in the rainy season, the Salt Desert must, comparatively speaking, be a pleasant spot. As one gets further into it the lines of borassus palms are scarcer, and the country appears to be an unbroken rolling prairie, till every now and then a deep hollow, invisible till the edge is reached, is suddenly come upon. Some of these hollows were dry or drying, whilst others contained water deep enough for hippopotami. Round the edge of the water is usually a dense fringe of handsome feathery reeds, infested by large and fierce mosquitoes, and on the firm ground round the reeds again a thick belt of borassus palms. The hollows were of varying sizes and shapes, sometimes roughly circular and about half a mile to a mile across, and about 100 feet or more in depth. Others were long and irregular in outline. They always formed, when there was water in them, a pleasing and welcome picture. I could find no way of accounting for their origin except on the supposition that they are craters or crevices in the lava-sheets that probably underlie the sand,

VIEW OF BEBEJI, SOUTH OF KANO.

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thick forest. This is fringed with a belt of euphorbia, of varying depth, and then the open grassy plain falls very gently to the marshes. These, with patches of open water, appear to extend right across the lake in its southern portion, whilst the northern is much freer. Owing to the absence of any sufficiently high ground near the shore, and to the Harmattan haze, it was impossible to get any very extended view. From the sand-dunes near Barrua large stretches of open water were visible, and again, near the mouth of the Yo river, the lake appeared to be free from reeds up to the eastern horizon. Below this, on the shore opposite Aregi, where we camped on New Year's Day, and for some 15 miles southward, a line of breakers could be seen and heard along the outer fringe of the marshes, but after wading out to this, the tops of grass and reeds were visible here and there above the water as far as the eye could reach. The strong Harmattan wind was blowing steadily throughout the day, and piling the waters on the western shore. About sunset it died away, and the lake receded some hundreds of yards before morning. The grassy plain lying between the forest and the marshes varies in width from 1 or 2 miles to 10 or more. Abundance of fish-bones and hippo skulls scattered over it showed that it must at times be under water. I do not, however, believe that the rainfall in the Chad basin can ever raise the level of the lake considerably. It seems like other great lakes, notably Lake Van in eastern Turkey in Asia, to have periods of high lake at a certain regular interval of years. Between these the lake gradually falls and then rises again. This was brought to my notice by Colonel Jackson, of the Anglo-German Boundary Commission, who, no doubt, will be able to throw a good deal more light on the subject. The high and low water level, then, cannot depend directly on the annual rainfall, but is possibly due to some large underground syphon or system of syphons, which take a certain number of years to fill and empty. Curiously enough, if I remember rightly, the period given me by Colonel Jackson for Lake Chad, eleven years, is the same as that for Lake Van. It would be interesting to get reliable statistics on the periods of high and low water of the various lakes subject to this phenomenon.

In the waterless districts we had passed through from the Niger game was scarce and wild. Now, as we rode along the shores of the lake, we had animals of some sort ever in sight. Herds of korrigon, a species of hartebeeste first found on Lake Chad by Denham, gazelles of several species, notably a very handsome red and white one that may prove to be a new sub-species of the *Gazella Dama*, galloped away from us all over the grassy plain. The marshes were full of wildfowl, and close to or in them, that handsome little antelope, the cob, stood up to gaze at the passing caravan. A few ostriches were seen, and one was found sitting on its nest, a hollow in the sand containing 21 eggs. Hippo tracks were plentiful, and occasionally a herd of elephants, noblest

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results of this expedition there are many of great interest, and some of them perhaps a little unexpected. Among them are the geological results which have been alluded to by Colonel Elliot in his paper. The officers of the expedition fortunately brought home with them a fair number of fossils, which were collected at various points upon this boundary-line, especially near Garadumi, which you will see on the arc near longitude six, and at Tamaské, which I think is further to the west. These fossils were brought to the British Museum, and were studied by Mr. Bullen Newton and myself. Fossils were also found by the French officers on the expedition, and there have been some remarks published on these, though they are not yet described. In ignorance of this, we studied these fossils, and we came to the same conclusion as the French scientists came to. The fossils are shells and sea-urchins for the most part, and the important point about them is that they denote the existence of a rock of Eocene age, which rock had not previously been found in that district. Rocks of similar age occur along the northern part of Africa towards Tripoli and Tunis. They are also known to pass through Arabia and down towards Somaliland, but in the district south of Algeria no rocks of this age had been previously known to exist. It is true that some years ago Rohlfs mentioned that he had seen ammonites in the neighbourhood of Bilma, which is a little north-west of Chad, and Cretaceous rocks were found there by the officers of the French expedition, and also by Colonel Monteil, whose name has been mentioned this evening. Now, the existence of Eocene rocks is a point of importance, not merely as showing an extension of the sea over the southern part of the Sahara in those times, but as affording some confirmation of the views of Suess, who has supposed that, while the lower triangle of Africa was raised out of the sea at a very early geological age, all this Saharan part of Africa, together with the present Mediterranean, Arabia, and the North-West Provinces of India, formed one great Mediterranean sea. We have here proof for the first time that this sea actually did exist down to Sokoto, or at all events a little to the north of Sokoto, forming the southern limit of the present Sahara. And what is an interesting point in these fossils, and still further confirmation of these views, is that some of the fossils that have been found are distinctly of Indian character. One of the sea-urchins is of a kind which has hitherto only been described from Sindh. It is very interesting to learn, though the fact has not yet been definitely published, that a species of the same genus has recently been found in Egypt. We have, therefore, some evidence—pretty good as these things go—for a definite connection through Egypt and Arabia with the North-West Provinces of India. The Cretaceous rocks, which have been proved by the existence of fossils, have been proved to come down from the south towards Bilma, north of Lake Chad. And one of the fossils, a fossil which was found by Colonel Monteil some ten or twelve years ago, was lying about for a long time till Prof. A. de Lapparent happened to catch a glimpse of it, and, recognizing its importance, had it described by a specialist in palæontology, who discovered that it was the same thing as a kind of sea-urchin which was found quite recently in Beluchistan, in fossils of Cretaceous age there. Here we have a proof of the connection of India and the Sahara in Cretaceous times as well as in the later Tertiary times. There is just one little interesting point here with regard to the theories of Prof. Suess. He has maintained that the raising of the sea-floor began in very old times, and that it went on continuously, and that the Cretaceous rocks were raised up soon after they were formed, so that the Tertiary rocks were always found, as it were, within the limits of the Cretaceous rocks. As we in England find the Chalk to the north of the London basin—further north than the London Clay, so here in Africa up to now they have found the Chalk south of the Tertiary rocks—that is to say, the

Chalk goes all round and the Tertiary rocks lie inside. The Chalk which underlies the Tertiary rocks was raised up while the Tertiary rocks were being deposited. Well, now, our facts at present are, thanks to Colonel Elliot and his associates, that we know the Tertiary rocks are further south than the Cretaceous rocks; that is to say, they are outside the supposed circle. What we have to do now is to find out whether the Cretaceous rocks do not occur further south still.* Otherwise, instead of this basin being raised up regularly, we shall have a sort of lop-sided arrangement; it will have been raised more on the north than the south. These are some general questions of very great interest, which arise out of just one simple point in the labours of this expedition. I may venture to speak just at present on behalf of my colleagues at the British Museum. We express our deep thanks to Colonel Elliot and his fellow-officers who have brought home these specimens, which are not so easy to collect as one might think, because of the great heat and the difficulty of getting them home, and have now presented them to the British Museum. You can see them in the adjoining room after the meeting.

The PRESIDENT: We must all have been struck with the great interest that attaches to Colonel Elliot's paper in various ways, more especially the discovery of fossils, the importance of which has been explained to us in such an interesting way by Mr. Bather. I would now propose a very cordial vote of thanks to Colonel Elliot for his interesting paper, and for the illustrations with which it has been accompanied.

A NOTICE OF SOME MARINE TERTIARY FOSSILS FROM NORTHERN NIGERIA, COLLECTED BY COLONEL G. S. McD. ELLIOT, R.E., AND CAPTAIN LELEAN, R.A.M.C., OF THE ANGLO-FRENCH BOUNDARY COMMISSION.

By R. BULLEN NEWTON, F.G.S.

BRITISH MUSEUM (NAT. HIST.).

SOME interesting marine Tertiary fossils have been recently presented to the British Museum by Colonel Elliot and Captain Lelean, who obtained them from Kalfu-Tamaské and Garadimi, in Northern Nigeria. A study of these specimens, which consist of molluscan remains and well-preserved Echinoids, undoubtedly confirms what has already been made known to us by Prof. A. de Lapparent,† as to the presence of Eocene (Lutetian) rocks in this part of the Sudan area of Africa. The material on which Lapparent based his conclusions was discovered by Captain Gaden at the same place, viz. Tamaské, 400 kilometres west of Zinder, and comprised the following shells and Echinoids, the latter having been determined by M. Victor Gauthier: **Mollusca**—*Nautilus cf. Lamarcki*, Deshayes. *Nerita (Velates) Schmideliana*, Chemnitz. *Lucina cf. gigantea*, Deshayes. **Echinoidea**—*Plesiolampas*, n. sp. *Linthia cf. Ducrocqui*, Cotteau. *Rhabdocidaris (Leiocidaris)*.

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* This supposition is now confirmed. The British Museum has recently received some Ammonites, Lamellibranchs, and other fossils, determined by Mr. G. C. Crick as of Upper Cretaceous (Turonian) age, collected by C. L. Temple, S. of Gongola, Bauchi Province, Northern Nigeria. (Note added, September 8, 1904.)

† A. de Lapparent, "Sur les traces de la mer Lutétienne au Soudan," *Comptes Rendus*, 1903, vol. 136, p. 1118; "Sur de nouveaux fossiles du Soudan," *Comptes Rendus*, 1903, vol. 136, p. 1297.

Besides finding such fossils at Tamaské, Captain Gaden also noted their occurrence at different points of the country between that place and Chad, notably at Zinder and in the Damergou, situated to the south of Air. M. Douville, who had examined the *Nautilus*, regarded it as closely allied to *N. Lamarcki*, from the "Calcaire Grossier" of France, whilst M. Victor Gauthier was equally certain that the Echinoderms exhibited a Middle Eocene or Lutetian facies, the examples of *Linthia* being difficult to separate from Cotteau's *L. Ducrocqui* found in limestones of that age at Saint Palais (Charente-Inférieure), France.

The same Lutetian or middle Eocene aspect characterizes the fauna represented in the collection made by Colonel Elliot and Captain Lelean. Among the shells being the following forms: **Lamellibranchia**—*Ostrea cf. rarilamella*, Deshayes. *Alectryonia cf. Martinsi*, Archiac. *Vulsella Nigeriensis*, n. sp. *Spondylus cf. subspinosus*, Archiac. *Cardium*, sp. *Lucina cf. Menardi*, Deshayes. *L. cf. pharaonis*, Bellardi. *Lucina*, sp. indet. *Panopœa Sahariensis*, n. sp. **Gastropoda**—*Calyptrœa Nigeriensis*, n. sp. *Volutilithes cithara*, Lamarck. *Rostellaria cf. goniophora*, Bellardi. *Turritella cf. Ægyptiaca*, Mayer-Eymar. *Conus*, sp.

Some of these specimens are preserved as limestone casts, among them being several *Lucina*, which I have called *L. cf. Menardi* and *L. cf. Pharaonis*, and which represent, most probably, the forms referred to in Lapparent's paper as *L. cf. gigantea*. All three species, however, are typically Eocene, and have mostly been recorded from Egypt or southern European countries. The specimens of *Alectryonia cf. Martinsi*, originally described from India by J. de C. Sowerby under the name of *Ostrea orbicularis*, helps to support the theory that this ancient sea had an extensive eastward direction in Eocene times. The peculiar ostreiform genus *Vulsella* may also be referred to as characteristically Eocene, whilst among the Gastropods *Volutilithes cithara* is important from the distribution point of view being known from the Eocene areas of England, Europe, Egypt, and India.

The Echinoids of this collection evidently represent much the same forms referred to in Prof. de Lapparent's paper, but no further mention need be made of them on this occasion, as Dr. F. A. Bather is now preparing a detailed account of them for future publication.*

Fragmentary Foraminifera have been observed in microscopical sections of the limestones, the prevailing organism being *Operculina*, no Nummulites being observed.

Further Eocene areas in African territory north of the equator may now be briefly alluded to. Dr. Paul Oppenheim † has published a list of fossil marine shells collected by Dr. Esch in the Cameroons, which he regards as of Lutetian age, on account of the species characterizing beds of that age in the Paris basin. His determinations are as follows: *Cytherea nitidula*, *C. elegans*, *Tellina subrotunda*, *Sycum bulbiforme*, Lamarck.

Eocene rocks are again met with westward of the regions already mentioned. Prof. G. Vasseur ‡ having reported the occurrence of *Nummulites Gizehensis* of the *N. Ehrenbergi* group, which were obtained from a boring at a depth of 230 metres at St. Louis, in Senegal.

In the more northern and eastern parts of the African continent, similarly aged

placed in them being damaged. Above Jebba rapids are frequent, but they are negotiable by the skilled Nupe canoemen, till the Wurroo rapids are reached. Between this spot and Bussa there are a series of rapids, of which three are formidable. It is advisable, in fact necessary, to unload the canoes and send the loads round by land, whilst the canoes are hauled up empty.

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* Since the present notice was written, Dr. Bather's paper has been issued under the title of "Eocene Echinoids from Sokoto" (*Geological Magazine*, 1904, plate xi., pp. 292–304), containing figures and descriptions of *Plesiolampas Saharæ*, n. sp., and *Hemiaster sudanensis*, n. sp.

† Paul Oppenheim, "Vorläufige Mittheilung über das Auftreten von Eocän in Kamerun," *Centralblatt Mineralogie Geol. Pal.* (Stuttgart), 1903, No. 12, pp. 373, 374.

‡ G. Vasseur, "Sur la découverte du terrain nummulitique dans un sondage exécuté à Saint-Louis du Senegal," *Comptes Rendus*, 1902, vol. 134, pp. 60–63.

It was in one of these rapids that the dauntless Mungo Park met his death, when he appeared to be, after braving countless difficulties and dangers, on the point of solving the mystery of the Niger's course.

After surmounting the big rapids near Bussa, the river was still full of smaller ones that gave more or less trouble till, a few miles above Yelwa, a quieter section of the river was entered, and the journey to the frontier was accomplished without further difficulty.

Dole, near which village is the westernmost end of the boundary, lies a little way back from the Niger, on its left or eastern bank up a marsh-fringed creek. Marshes border the river for a mile or so in depth, and clumps of fan palms indicate spots where the ground is more solid. These trees are plentiful on the land side of the marshes and for some way up the Dallul Mauri.

Dallul Mauri, or the valley of the Mauris, the people of Arewa, is the name applied in the Convention to a depression that can be traced with more or less distinctness from near Matankari down to its junction with the Niger, the Dole creek being its mouth. It was once, I consider, a river valley, but no river or stream now flows along it, except perhaps during the rains there may be a current from marsh to marsh in the lower part of its course

JUNCTION OF RIVER NIGER WITH DELTA.

account of my travels, which appeared in several languages, as well as in delivering addresses before the most distinguished geographical societies in Europe. But as early as October, 1902, I petitioned His Majesty, Oscar II. of Sweden, for a public grant of money to enable me to publish the scientific results of my expedition. My request was referred by the Government to the Academy of Science in Stockholm, and the Academy appointed a committee of three members, consisting of Dr. E. W. Dahlgren, Prof. A. G. Nathorst, and Prof. Hj. Sjögren, who supported my petition, and in April, 1903, my request was granted by the Swedish Parliament. It is to the Parliament, therefore, that I in the first place owe my sincerest thanks, for having rendered it possible for me to publish the work in question; and I would also take this opportunity of expressing my thanks to the Swedish Minister of Ecclesiastical Affairs, Dr. Carl von Friesen, to Prof. Baron G. De Geer, as well as to Dr. E. W. Dahlgren, librarian-in-chief, whose counsel and assistance, coupled with their great experience, have been of the greatest possible value to me.

My object in the present paper is to give an account of the plan of this work, the manner in which it has been prepared and published, and especially of my own personal share in it—namely, the topographical map and the text dealing with the physical geography, which is so intimately connected with the map. I might, perhaps, call this paper, at one and the same time, a preface to the work and a criticism of it. I have thought it expedient to publish a preface in this way, because the preface proper cannot be printed until the entire work is completed and I am in a position to command a general view of the whole. My reason for printing this provisional preface—the final preface will be issued later on in a somewhat different form—is that students of geography may not be kept waiting for two years until the work is completed. With regard to the criticism, I am only too conscious of the defects in my work, and wish, therefore, to give here an idea of the *way in which* I worked in the field, and how, since my return, I have brought together and digested the material I collected. It is, however, a difficult task to write a criticism of one's own work; nevertheless, I will endeavour to be as just as I can.

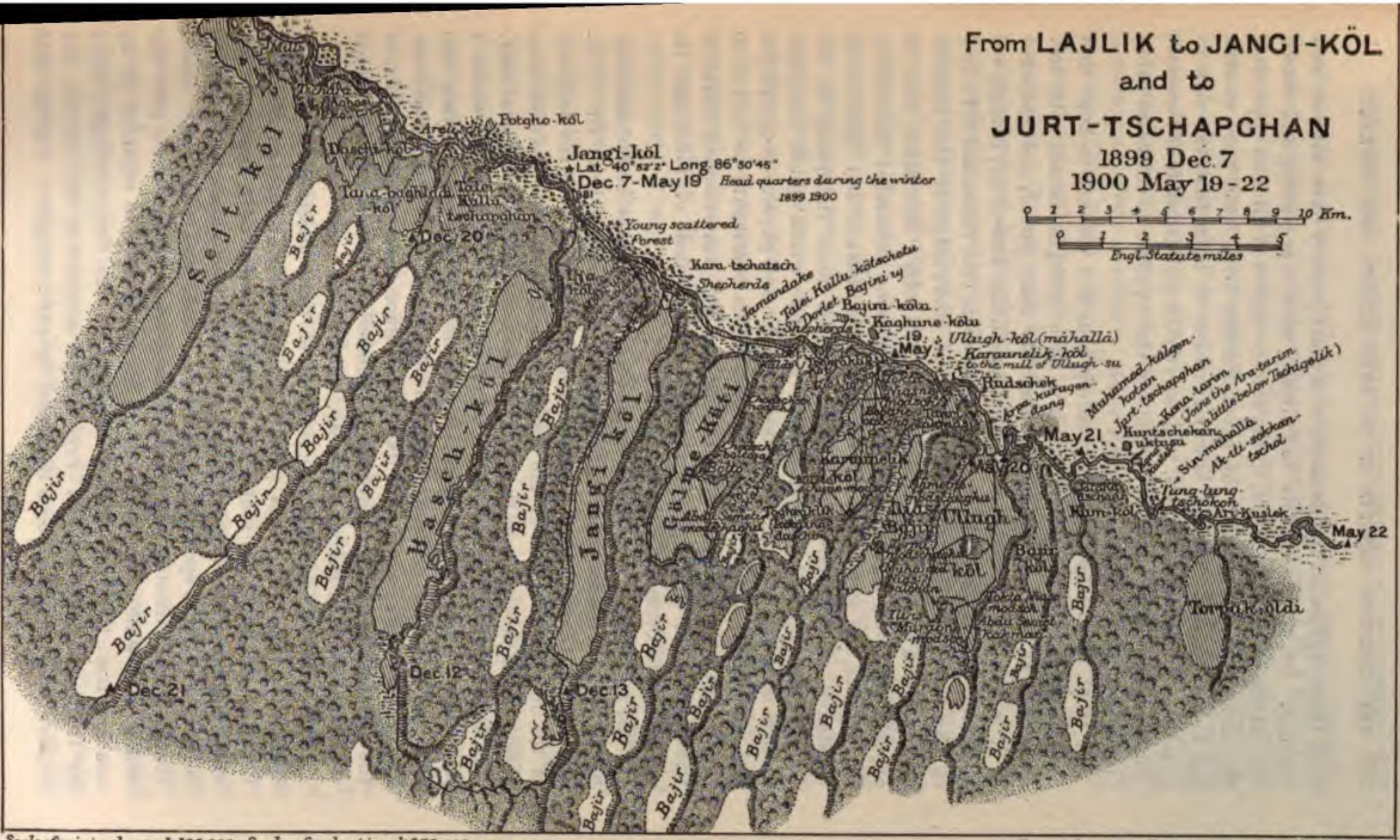
The 'Scientific Results of a Journey in Central Asia, 1899–1902,' was planned to appear in complete form before the end of the year 1906. As far as my own purely geographical text is concerned, it will be ready to publish by the autumn of 1905; indeed, at the moment of writing, fully three-fifths of the whole is already in manuscript. In the prospectus which I printed in the beginning of 1903, a flyleaf of which was distributed with one of the numbers of the *Geographical Journal*, I undertook to prepare a map of my journey on the scale of 1 : 100,000 and 1 : 200,000, in a hundred sheets, making an atlas of two folio volumes, and this was to be accompanied by 800 pages of text, illustrated by 500 cuts and various smaller maps. The other scientific results, collections, and different series of observations were to be dealt with by specialists. The text altogether was estimated to fill four or five volumes, and the edition was to consist of 250 copies at the price of £15 sterling.

Before very long, however, I perceived that the limits appointed were insufficient. No change will, however, be made with regard to the dissertations of my colleagues; but in the case of my own purely geographical work, I am driven to the necessity of making a very appreciable addition: instead of one volume of 800 pages, it will extend to four volumes of about 2000 pages in all. The first volume, now published, contains alone the 500 illustrations promised, and each of the three succeeding volumes will be just as profusely illustrated, with the possible exception of the second. Similarly, the atlas will in all probability extend to 120 sheets instead of 100. Nevertheless, after consultation with Dr. Dahlgren and my publisher, Mr. A. Lagrelius, I have resolved not to raise the price, despite the fact that the cost of the entire work will be very materially increased; indeed, the 75,000 kronor granted by the Swedish Parliament will be insufficient to cover it. The price, therefore (£15), is unusually cheap for a publication of this character. In view of the smallness of the issue and the low price, I would recommend those who are interested, and desire to have a copy of the work, to subscribe without delay. My reason for mentioning this is that even before the preliminary announcement of the work, a great number of copies were already ordered. And it may not be altogether without interest just now, that the first two subscribers to be enrolled hailed from Japan, namely Count Otani and the Geographical Society of Tokio.

I will say but a few words with regard to the treatises of my colleagues, for the purpose of this paper is to deal more particularly with the geographical side of the work. Volume v. will consist of two parts, one containing the meteorological observations, the other the astronomical. The former is dealt with by Dr. Nils Ekholm, and will embrace two divisions—the first, the series of actual observations themselves, will be published at the end of the present year; the second, the scientific discussion, in the spring of 1905. This part of the work promises to be rather voluminous, for it embraces observations made three times a day over a period of six years, for the meteorological results of my 1894–97 journey are also included. Moreover, for a period of more than one year the observations are double; that is to say, one series was taken by myself whilst on excursions, and another series at my fixed headquarters. The tables will also give the latitudes and longitudes of the several places of observation, with the possible exception of those in the Eastern Pamirs, this exception being due to the fact that the cartographical material which I brought home with me

From LAJLIK to JANGI-KÖL and to JURT-TSCHAPCHAN

1899 Dec. 7
1900 May 19-22



Scale of original map 1:100,000. Scale of reduction 1:250,000.

Generalstabens Litografiska Anstalt Stockholm from those regions on the occasion of my last journey have not yet been reduced. Dr. B. Hassenstein had already made a beginning and drawn the outline of the map when, to the sincere sorrow of all who appreciate the cartographical work of the great Perthes firm, death put a sudden end to his labours. I have, however, reason to hope that the map in question, the Eastern Pamirs, will shortly be published in *Petermanns Mitteilungen*, possibly in time to allow of the requisite co-ordinates being obtained to complete Dr. Ekholm's work.

I trust it will not appear presumptuous if I venture to hope that the meteorological material which I have brought home with me, extending as it does over such a relatively long period, and gathered as it is from parts of the world that are little known or, indeed, are absolutely unknown—that it may possess some real value, and fill a gap in our meteorological and climatological knowledge of the interior of the Earth's greatest continent. Dr. Ekholm's discussion may be expected to throw light upon several phenomena connected therewith; for instance, the occasion of the inconceivable violence and remarkable constancy of the east-north-east winds that blow in spring in the Lop-nor country and adjacent desert regions—winds which have had most to do with determining the configuration and physico-geographical and morphological features of that part of the continent; as well as to throw light upon the laws governing the not less constant westerly wind, which in winter blows throughout the whole of Tibet, and its possible connection with the monsoons.

The materials of my astronomical observations have been dealt with by Dr. K. G. Olsson, working under the direction of Prof. Dr. P. G. Rosén. Dr. Olsson has expressed himself as satisfied with the accuracy of the observations, and of the results which have been deduced from them. It is self-evident that the value of the 113 observations vary. The best are those which were taken at my headquarters, where I was able to repeat them several times; this enabled me to obtain also a valuable means of controlling the accuracy of my chronometers. Dr. Olsson's work, which will likewise embrace a scientific discussion of the material, is already three parts finished, and is intended to appear towards the end of the present year.

Vol. vi. will embrace descriptions of the collections I brought home with me. The first part of this, namely, Prof. Dr. Wilhelm Leche's account of the zoological collection, has already appeared. It consists almost entirely of skeletons and skins of mammals, but embraces only a very few specimens of reptiles, fish, and *Crustacea*. Small though this collection is, it may not be without interest, and the words with which Dr. Leche opens his paper may be regarded as an anachronism: "Only the most interesting of the forms brought home by Hedin are mentioned in Prjevalsky's account of his travels, but hitherto they have not been discussed by any zoologist." I grant that specimens of the forms alluded to have already been brought home by Russian travellers; but if they have never been studied by a specialist, they might as well still be in the deserts and mountains of Central Asia as be put away and forgotten in the museums of St. Petersburg. Prof. Leche's essay will be accompanied by eighty excellent illustrations in the text, and by five copper plates representing mounted skeletons of *Camelus bactrianus ferus*, *Equus Kiang*, *Bos grunniens ferus*, *Ovis Ammon*, and *Ursus pruinosus*. Travellers who are trained zoologists as well will no doubt regard this little collection with a certain degree of contempt, and reproach me for not having taken greater pains to augment it. To any such hypothetical reproach I can only reply that zoology does not belong to my special field of labour, and that I made this collection more to gratify my own pleasure or fill an idle hour than with the view of satisfying the demands of the zoological specialist; and if I were maliciously inclined I might proceed to ask my critic a question or two about the geographical and cartographical materials he brought home with him when he was travelling for specially zoological purposes. In general, I have made it a rule to stick to my own special sphere of work, namely, geography and map making, in which I am at home. The material, therefore, which I offer in vol. vi. is of necessity defective, and always occupied a secondary consideration in my regards. It is impossible for one man to be master of everything. It must also be remembered that the skeletons and other parts of my collections had to be carried thousands of miles through Asia, being day after day loaded up on the backs of camels and unloaded again, very often under accompanying circumstances of the most unfavourable character.

The same remarks apply to the botanical collection: it is very small, and was gathered by a "layman" who has no idea of botany, and plucked his flowers *en passant*. The collection, such as it is, is being dealt with by Prof. Dr. G. Lagerheim, who is now engaged upon it, though he has handed over certain sections to other specialists, *e.g.* the *Algæ* to Prof. Dr. Nils Wille.

The geological collection consists of about seven hundred specimens, and is being dealt with by Dr. H. Bäckström and other geologists. I have, however, thought it expedient, in my geographical account of Tibet, to mention briefly the varieties of rock I observed in crossing the several mountain ranges. As, however, the identifications rest solely upon a superficial macroscopical observation, they do not possess more than a general value, and require to be completed by the more minute microscopical investigations of specialists. A number of specimens of sand, and various kinds of soil and salt, have been examined by Prof. Baron De Geer, assisted by Mr. G. Aminoff.

To all these gentlemen, who have so readily and so disinterestedly undertaken to throw the light of their special experience upon the

placed in them being damaged. Above Jebba rapids are frequent, but they are negotiable by the skilled Nupe canoemen, till the Wurroo rapids are reached. Between this spot and Bussa there are a series of rapids, of which three are formidable. It is advisable, in fact necessary, to unload the canoes and send the loads round by land, whilst the canoes are hauled up empty.

It was in one of these rapids that the dauntless Mungo Park met his death, when he appeared to be, after braving countless difficulties and dangers, on the point of solving the mystery of the Niger's course.

After surmounting the big rapids near Bussa, the river was still full of smaller ones that gave more or less trouble till, a few miles above Yelwa, a quieter section of the river was entered, and the journey to the frontier was accomplished without further difficulty.

Dole, near which village is the westernmost end of the boundary, lies a little way back from the Niger, on its left or eastern bank up a marsh-fringed creek. Marshes border the river for a mile or so in depth, and clumps of fan palms indicate spots where the ground is more solid. These trees are plentiful on the land side of the marshes and for some way up the Dallul Mauri.

Dallul Mauri, or the valley of the Mauris, the people of Arewa, is the name applied in the Convention to a depression that can be traced with more or less distinctness from near Matankari down to its junction with the Niger, the Dole creek being its mouth. It was once, I consider, a river valley, but no river or stream now flows along it, except perhaps during the rains there may be a current from marsh to marsh in the lower part of its course

JUNCTION OF RIVER NIGER WITH DELTA.

Niya river; further, several written fragments of old papers of different kinds, and letters on wood, of the same kind as those illustrated in Stein's 'Preliminary Report.' On several of these tablets, wooden letters, and scraps of paper we find the name of the ancient kingdom of Lôu-lan. That this ancient state was situated on Lop-nor we know from one of its old names, *e.g.* Lao-lan-hai, or Lôu-lan-hai."

Yes, Himly's work would have furnished an historical and ethnographical proof that the solution of the Lop-nor problem at which I had arrived upon purely physico-geographical grounds is sound and definitive. Himly had already selected from the materials I placed at his disposal the manuscripts and other objects which he wished to use in illustration of his text, and they have been photographed by his brother, Captain Eugen Himly, and will be published, together with the completed text, in the 'Scientific Results.'

I now pass on to the atlas, the *pièce de resistance* of the entire work. My original map consists of 1149 sheets, the length of the actual red-lined itinerary on which amounts to nearly 1000 feet, though the distance actually travelled was over 6200 miles. The scale varies, being on the whole 1 : 30,000 to 1 : 40,000, and reproduces the morphological characteristics in the minutest detail. My field instruments were a chronometer and a compass; by the latter I determined the direction, taking numerous observations, sometimes as many as two hundred in a day, and by the former I measured the distance. I must add that I always kept a check upon the rate of movement. This method may appear very simple, but it has, at any rate, yielded amazingly accurate results. With help of this method, *i.e.* this topographical apparatus, I would venture, starting from any fixed astronomical point, to make a traverse to any other known point you please, and at almost any distance. In other words, I have the most absolute confidence in the accuracy of my method, *i.e.* on the assumption, of course, that the distance is always calculated with the greatest accuracy, and base-lines are measured every day for the control of the rate of speed or velocity. In general, the results obtained on land are better than those obtained on water, although the safest of all are those got in calm weather on stationary water. But when a river is used for motive power, the calculation of the distances is never so reliable, owing to the continual variation in the velocity of the stream, and the difficulty in most cases of measuring its amount with sufficient frequency. This is especially the case where the velocity is great, and the current carries the means of transport along with great rapidity. In general, the distance under such conditions tends to come out too short.

I cannot here give a detailed account of the devices I adopted for indicating the various different features of the country travelled through. All the land-maps of my journey will be published on the scale of 1 : 200,000, except that of the route from Kashgar to Lailik, which is on the scale of 1 : 100,000. My original drawing is, therefore, so reduced in scale that a great part of the finer details are necessarily lost. This is, indeed, very much to be regretted, especially as several judges, including Lord Curzon, to whom I showed about a hundred of my sheets in Calcutta, expressed the opinion that the maps ought to be published on the scale to which they were originally drawn; but, on the other hand, there are great difficulties, both practical and financial, in the way of issuing a considerable atlas on a larger scale than 1 : 200,000. It is, therefore, the maps of the Tarim river only that are issued on the scale of 1 : 100,000. At the same time, with the view of giving some idea of the methods I employed in depicting the features of the country I travelled through, I have included in the atlas a number of the original sheets in facsimile, selected from different parts of the interior of Asia. This will also afford the student an opportunity of comparing the original work with the map that has been constructed upon it. In this way my own hand-drawn maps, which took three years of strenuous labour and unintermittent attention, will not disappear entirely in the printed maps, but will also remain, at any rate in part, as evidence of the work I accomplished.

In the labour of reducing, reconstructing, and drawing for the purposes of reproduction, I have had the great good fortune to find exceptionally skilful and experienced colleagues in Major H. Byström and Lieut. O. Kjellström. As a model we have followed in this respect the large atlas, on the scale of 1 : 200,000, which Dr. B. Hassenstein drew to accompany the account of my former journey, and of which six sheets were printed on a reduced scale in *Petermanns Mitteilungen*, Ergänzungsheft No. 131. Owing to Herr Perthes' courtesy, I have been allowed to borrow this atlas for the time being. I think it but just to my colleagues to say that the results of their labours will bear comparison with the best work of the kind that has been produced outside of Sweden. A glance at the first sixteen sheets of the published atlas will convince the expert that my words are no exaggeration. Of these sixteen sheets all have been constructed by Major H. Byström, and twelve have likewise been drawn by him; the other four are drawn by Lieut. O. Kjellström. In addition to these, twelve other sheets are ready, and will be published in the autumn, while my two colleagues, whose industry is as admirable as their skill, are busily engaged upon the rest. Owing to his long and great experience, Major Byström was able, as early as the summer of 1902, to draw up the plan of the entire atlas, to determine its size and the method of reproduction, as well as to select the many technical devices which are necessarily required in a work of the kind, and the atlas was then and there begun.

In addition to these sixteen sheets, which embrace my Tarim journey as far as Yanghi-Kul, the Cherchen desert, and my journey to Bostan-toghrak, we are now publishing six sheets in facsimile. The atlas proper is estimated to contain about eighty-five sheets, fifteen or sixteen of which will be on the scale of 1 : 100,000, and all the rest 1 : 200,000. Meanwhile, with the view of making the cartographical material more accessible, as well as to facilitate a general view of the entire region traversed, we did at one time contemplate incorporating in the atlas a general map in four sheets on the scale of 1 : 2,000,000. But further reflection has convinced me that, in view of Penck's proposal to prepare a map of the entire Earth on the scale of 1 : 1,000,000, it would be more expedient to publish the general map on the scale of 1 : 1,000,000 and in sixteen sheets. Another advantage attaching to this change of plan is, that the substituted map would be drawn on the same scale as that which Hassenstein prepared after my former journey. The new general map would embrace the whole of the material used by Hassenstein, together with as much as possible of the results obtained by other travellers. In a word, it would reproduce *everything* we know down to the present date about the geography of Central Asia. For the preparation of such a map, which will of course entail incomparably greater expense and involve more labour than a general map in only four sheets, I hope to be able to draw upon the experience, as well as upon the collection of materials in the hands of Justus Perthes' Geographische Anstalt, for it is only there that a map of this magnitude could be produced. I should be glad to learn that the plan of a map on this scale meets with the approval and moral support of geographers, a support which may legitimately be asked for before such a costly step is finally taken.

Thus the atlas and general map together will make in all about 100 sheets. In addition to these, there are about a score of sheets in facsimile, forming an independent series, numbered with Roman numerals. These sheets are selected with the view of giving an idea of different types of conformation, with all the natural details that belong to them. The six sheets now issued reproduce in this way very different parts of the Tarim. From these, and in a still higher degree from those sheets which represent the mountainous parts of Tibet, the reader will be able to see to what extent the details originally incorporated have become lost in the process of reduction.

But there exists another practical reason for the publication of these facsimiles, namely, the hope that they may be of assistance to younger explorers who may follow after me. Moreover, I venture to hope, also, that my atlas may serve as a guide, which, although costly, will be practical and useful, to the first preliminary mapping of an unknown country.

In this connection I would also desire to express publicly my hearty thanks to Major H. Byström and Lieut. Kjellström for their very excellent technical work, and for the pleasure it has given me to labour in conjunction with them; for I have, of course, to superintend their labour and to be responsible for it.

It only remains that I should give some account of my own text, first indicating in a few words the way in which it is divided and arranged, and then adding a sentence or two by way of criticism.

The text will embrace four volumes—Vol. i. The Tarim River; vol. ii. Lop-nor; vol. iii. Northern and Eastern Tibet; vol. iv. Central and Western Tibet. The little vignette map is intended to give a bird's-eye view of the distribution of the geographical material.

For purely practical reasons I have written the original in Swedish: one naturally writes with greater freedom, as well as more rapidly, in one's own mother-tongue than in a foreign language. At the same time, I was fully convinced from the very beginning of the absolute necessity of publishing the work in one of the three great world-languages, and after consultation with Dr. Dahlgren I selected English, not only because it is the most distinguished, but also because it has the widest circulation, and consequently we might hope that the work would secure the largest number of subscribers in Great Britain, the United States, and India. My manuscript has therefore been translated, and I have had the good fortune to find in Mr. J. T. Bealby, B.A., of London, an excellent translator, almost as well versed in Swedish as in his native tongue, who, moreover, has had the advantage of a long acquaintance with my style, for it was Mr. Bealby who translated 'Through Asia,' and 'Central Asia and Tibet.' Mr. Bealby is, moreover, a man of great learning and many-sided culture, and has had considerable experience in translating for the *Geographical Journal*. I feel confident, therefore, that the English of the 'Scientific Results' does full justice to the original Swedish, and I owe Mr. Bealby many and sincere thanks for his conscientious and unwearied labour. With the view of guarding against possible misunderstandings on the part of the translator, I may add that I have myself read two successive proofs of the whole, comparing the translation word for word with the Swedish original, and I hold myself responsible for the matter in the fullest acceptation of the term, as well as for the numerical data, geographical names, etc., etc. Mr. Bealby has also read two successive proofs, and is responsible for the orthography and style of the English. Any errors that may have escaped our conjoint vigilance must be set down as misprints. Dr. K. B. Wiklund also read a proof of the first half of the first volume, but unfortunately was unable to continue owing to illness, and I have taken it upon me to complete his work.

By the express wish of Dr. E. W. Dahlgren, I applied to Dr. K. B. Wiklund, Lecturer in Finnish-Ugrish Philology at the University of Upsala, with the view of securing a consistent orthographical system in the writing of the geographical names, and found in him the first authority in that particular field that Sweden possesses. At a later stage Dr. Wiklund will himself explain his system; here it will suffice if I point out one or two of its salient features, which it will be important, especially for English-speaking readers, to bear in mind. For instance, Dr. Wiklund writes *tsch* instead of *tj*, *dsch* instead of *dj*, *ch* instead of *kh* (*sch* instead of the English *sh* and French *ch*), *gh* in words with open vowels, *g* in words with closed vowels, as well as in general reducing the vowels to conformity with the pronunciation employed for the language of East Turkestan in Radloff's Dictionary —that is, as far as it has appeared. Dr. Wiklund tells me, however, that in several cases he has not been quite consistent, but has varied his practice, especially in the employment of *e* and *ä*. He finds that my transcription of these sounds is erroneous—a consequence, in part, of my being a native of Stockholm, to whom the difference between *e* and *ä* is not very distinct. He also considers that it is in part due to the fact that I have often taken the unaccented syllable *a* for an *e*—a common mistake in the case of an ear that is not phonetically trained. He also suspects that I have sometimes mistaken an *i* for an *e*. For these reasons Dr. Wiklund has felt it expedient to depart from strict consistency, and has not written all my *e*'s as *ä*'s, for by so doing a number of *ä*'s and *i*'s would have been incorrectly transcribed. He has therefore confined himself to writing *ä* where he has been able to find the word in the dictionaries, and ascertained that in the book language of East Turkestan the vowel has the sound of *ä*. For instance, he has written my *besch* (= " five,") and *seksan* (= " eighty ") as *bisch* and *siksan*, both to bring them into conformity with the literary language and to avoid the multiplication of dialectal forms. For the same reason he has often altered the genitive termination *-ne* into *-ning*, although in certain characteristic words we have resolved, after consultation together, to make no alteration. Consequently, in the text, as well as in the atlas, both these terminations will be found, to say nothing of several other genitive suffixes that are characteristic of the Lop country. In certain words we have not slavishly followed the orthography of the literary language, but have preferred to retain the dialectal differences. For instance, the word *jarsik* (= " river lagoon ") we have often written *jasik*, *jarsuk*, and *jasuk*. It has, however, been very difficult to discriminate consistently between *gh* and *g*. The general rule laid down above is not, on the whole, difficult to follow; but, on the other hand, it is uncertain whether *i* ought to be regarded as an open or a closed vowel. For this reason we have written both *igis* and *ighis* (= " high "). But in the case of a word like Ugen-daria the uncertainty is even greater. " What is the value of *u* in this word ? " asks Dr. Wiklund. " Is it the Swedish *u*, resembling the sound of *y*, or is it the European *u ?* In other words, ought the word to be written *ugen* or *ugl en ?* " The question cannot be decided ; accordingly, I have preferred to keep to *Ugen*-daria, the form adopted in *Petermanns Mitteilungen*, Ergänzungsheft No. 131.

Generally, Dr. Wiklund has abbreviated the long intervocalic consonants, though not always, because, as he justly observes, the double forms *may* be found in the dialects: thus he writes *attam*, and not *atam* (="my father"). With regard to the word *Muhamed*, it is sometimes written with a double *m*, although that is an incorrect form. In the second half of the first volume certain violations of the rules of the system as here laid down are entirely due to my fault, owing, as I have said above, to Dr. Wiklund's illness and my having to continue his work single handed before I had acquired complete mastery of it. The spelling *sogot* for *soghot* in two or three places is a pure mistake. I have preferred the old spelling Ettek-tarim instead of Ätäk-tarim, although the latter would have been more consistent. In the discussion at the end of vol ii., in which Dr. Wiklund deals with geographical names, as well as with the system of transcription adopted, any errors of this kind will be corrected. Small inconsistencies that we have been unable to avoid altogether are, of course, of less importance from the geographical than from the philological point of view.

I need hardly say that in the 'Scientific Results' I have used exclusively the metric system, as well as the thermometric scale of my countryman Anders Celsius, professor at Upsala; and it is not my fault if the conservatism of the English-speaking world makes these two systems less familiar than they ought to be to the readers of the book.

And now to come to my text. All I claim for my work is that it amounts to "Begleitworte zu den Karten;" in other words, it is an explanatory text to the atlas, and its contents are purely physico-geographical, forming a topographical, morphological, hydrographical, and orographical description of the regions traversed. The reader will in vain look for any new strokes of genius or epoch-making ideas of a similar character to those in Richthofen's 'China,' or Peschel's 'Neue Probleme.' What I am in a position to offer to geographers and serious students of geography is only a faithful geographical description, rather dry, but rich perhaps in new facts and geographical discoveries. For this reason I have arranged my text in diarial form, recording each day the observations made, so that in this way the text furnishes a detailed commentary, day by day and sheet by sheet, to the maps in the atlas. This has rendered my task easier and readier of accomplishment, and the connected study which, with the help of Supan's 'Physische Erdkunde' and certain other text-books, I made whilst the journey was in progress, is thus reproduced in my book in its natural order and sequence of development. Possibly this chronological arrangement will occasion the reader some difficulty, and make the 'Scientific Results' an unmanageable work of reference; and the fact that the first volume, now published, contains no index, is perhaps calculated to emphasize these drawbacks. This defect will, however, be made good in due season. The first and second volumes, which treat of the geography of East Turkestan, are so intimately connected that I thought it best to give them one common index or rather two indexes, which will be printed at the end of vol. ii. The first, containing a list of all the geographical names that occur in the two volumes, will be prepared by Dr. Wiklund; the other, an index of the contents and matters of fact, will be compiled by Mr. Bealby.

The reader of vol. i. will no doubt be astonished at not finding a single quotation in its 512 pages. It is nowadays esteemed a merit to overload a scientific work with quotations of every sort and degree: they are a proof of wide reading and learning. I confess at once that I can lay no claim to either of these qualifications; and I trust the impartial reader will find excuses for me when I say that, having spent a large part of my life in travel, I literally have *not been able* to keep up with the progress and development of geographical study in other parts of the world, and still less with the faithful but laborious results of arranging and cataloguing which learned armchair geographers so unweariedly carry out. I willingly admit that it is with a certain amount of respect I turn over the productions of stay-at-home scholars; but I must say that I prefer a thousand times to turn over the great open book of Nature, and especially those parts of it which have not yet got stowed away in any library. Whilst engaged on my journeys, it will be perfectly evident that I have not many spare minutes for reading; and since my return home the preparation of my observations for publication has claimed the whole of my time, to say nothing of the immense amount of labour involved in controlling the whole, in replying to the innumerable questions of those who are co-operating with me, in keeping an eye day by day upon the preparation of the maps, and in reading through piles of proofs, and, lastly, in using my further "leisure" to continue my own proper work. Under these circumstances I have found it impossible to do anything in the way of comparative geography, having found quite enough to do to write down, without comment and without ornament, the bare story of my own independent observations. The comparative discussion I leave to scholars at home, whose time is not taken up with the actual work of exploration. And when it is remembered that I have always worked alone, without any European colleague or assistant, and that the materials which I have collected have often been brought together under extremely difficult external conditions (of which I have given an account in my book 'Central Asia and Tibet'), the reader will, I trust, be willing to acknowledge that I have tried to do my best. In the second volume, however, the reader will find a number of comparisons and quotations bearing upon the sandy deserts and their origin, as well as upon the formation and movement of the dunes, drawn almost entirely from the works of Russian travellers in Asia—works which are in great part inaccessible owing to the general unfamiliarity with the Russian language.

From what I have already said, the reader will see that I have not bound myself by other authorities, and have not slavishly followed the views and conclusions of other explorers, but have recorded my own independent observations, just as I made them, and give them for whatever they are worth. Direct observations always have a positive value; as for discussions about cause and effect, the reader can accept whatever he thinks well and reject the rest. Some of the theories I put forward may possibly appear too bold, but they embody, at any rate, my own convictions.

Vol. i. is entitled 'The Tarim River,' and consists of four principal sections—the Tarim River, the Lakes beside the Lower Tarim, the Cherchen Desert, and the Tarim Delta, divided into thirty chapters. In brief, vol. i. deals with the Tarim system from Lailik all the way to Abdal, together with that part of the great sandy desert that is situated between the lowermost Tarim and the Cherchen-daria. Vol. ii. is concerned with the Kara-koshun, the Kuruk-tagh, a part of the desert of Gobi, the desert of Lop, and above all the former Lake of Lop-nor and its history. This arrangement of the subject may perhaps strike the reader as incongruous, in that the description of the Tarim system is interrupted by the account of the desert of Cherchen. The reason is that I desired to discuss the desert lakes of the Tarim immediately after describing that river, for the two are inseparably connected, and this necessitated my giving an account of the *bajirs* of the desert of Cherchen in close connection with them, for the two phenomena, the lakes of the Tarim and the *bajir* depressions, are intimately associated. In consequence of this, vol. i. swelled out to such dimensions that there was no room in it for the Kara-koshun, which is, of course, quite as closely connected with the Tarim as any other of its lakes. To describe the Kara-koshun without reference to the Lop-nor problem would be absolutely impossible. I had, therefore, to abandon my original plan, by which vol. i. was intended to embrace the Tarim system and its terminal lake, while vol. ii. was to deal with the adjacent deserts and the problems they suggest. However, with the idea of furnishing a general view of the Tarim system, vol. ii. contains, first of all, a review of the entire river system, with illustrative maps in the text, as well as bathymetrical and other measurements.

Hydrographical specialists will probably be disposed to accuse me of dwelling on matters of too elementary a character, when I give the variations of the river at different seasons, the phenomena connected with its erosive energy, its alluvia, and so forth; but, as I have remarked above, I have written down my own observations, no matter what their value and significance, and they possess at any rate this merit—that they will at least confirm observations which have been made scores of times before.

Vol. i. is profusely illustrated. It contains 448 cuts in the text, 39 lithographic plates, and 17 maps and vertical sections. The autotypes consist for the most part of reproductions of my own photographs; in addition to them there are a number of drawings by my own pencil, which of course make no pretensions to artistic excellence, but all the same serve the purpose of illustrating the text. Of the cuts in the text, 95 consist of vertical sections or profiles through the Tarim and its tributaries, showing the depth, breadth, and velocity. Dr. N. Ekholm explains, in a couple of pages, the method he has employed for calculating the volume from the material thus supplied. From the observed velocities—that is to say, the river's fall, he has obtained also the means of determining the absolute altitudes, or rather the means of controlling the results furnished by the boiling-point thermometers, the aneroids, and the barometers. A special chapter of vol. ii. contains a list of absolute altitudes for the basin of the Tarim, and for defining the shape of the basin as a whole. These have been deduced by Dr. Ekholm from the absolute altitudes I have supplied to him.

The full-page lithographic plates have been executed by Lagrelius & Westphal of Stockholm, being reproductions of my negatives taken on Edwards's plates. All the large photographs were taken with a camera by Watson of London, and about a thousand of the small photographs on glass were taken with a Richard's Verascope camera. Both these cameras yielded excellent results; but for the future I shall fight shy of Eastman's Kodak, for it was only exceptionally that my Kodak yielded passable results. Fortunately, my supply of glass plates was so great that even in these four volumes I have found it impossible to use them all.

Perhaps it may be objected that in vol. i. I have introduced a number of pictures which have no direct bearing upon the text. This applies especially to the groups of natives, which, strictly speaking, are out of place there, for this work deals exclusively with the country, and not with the people. Nevertheless, I have not hesitated to print them, and for two reasons—in the first place, it will do no harm; and in the second place, it is precisely because the natives do not figure in the text that I have thought they might have a place in the illustrations. In vol. ii. I intend, unless the expense prove too heavy, to include a number of drawings I have made, illustrating racial types from Central and Western Asia.

The small sketch-maps in the text have been for the most part redrawn by Lieut. O. Kjellström in a very meritorious manner, and with praiseworthy industry. These small sketch-maps, as also the large maps in the atlas and all the autotypes, have been executed by the Lithographic Institute of the General Staff of the Swedish Army, the chief of which, Mr. A. Lagrelius, who is also my publisher, has rendered me the most disinterested and valuable assistance, both in counsel and in deed, even with regard to the minutest details, for which I beg to thank him sincerely. The book is being printed by Messrs. P. A. Norstedt & Sons, under the superintendence of Mr. Carl Ramström, who has devoted to it his best attention. In the production of this book, I have laid it down as a fixed rule, that all the work connected with it should be executed in Sweden, so that foreign countries may have an opportunity of seeing what we are able to accomplish in this line here in Stockholm. At the suggestion of Prof. Supan and Dr. H. Wichmann, I add, as an appendix to this paper, one of the maps we are now publishing, the only difference being that in the atlas it is printed on thicker and more expensive paper. The sheet in question, Plate 10 in the atlas, has been composed and drawn by Major Byström from my original drawing, which was on a scale three times as big. The topographical features—that is to say, the sand-dunes—are drawn by Lieut. O. Kjellström. The most interesting sheet of the now published part of my atlas is, however, Plate 12. The explanatory text to this one sheet alone occupies eighty pages of vol. i., and is illustrated by four special maps of the lakes sounded, and three general maps throwing light upon the genesis of the region. I may perhaps be permitted, in a few words, to indicate the physico-geographical phenomena which have given rise to unusual and regular structure of this region, which is one of the most curious and interesting on the whole Earth. As the main stem and backbone, or rather as the principal artery, of this map we may with justice regard the Tarim, which is here flowing towards the south-east. On its left bank we have my headquarters at Yanghi-Kul, where my caravan spent the winter from December 7, 1899, to May 19, 1900. It was from this point I started on my two great excursions—one through the desert of Cherchen (the first two days of travel are shown on Plate 12), and the other through the desert of Lop; as well as the two shorter excursions I made to the lakes of Bash-Kul, Yanghi-Kul, and Gulme-Keti. Moreover, the map shows the first three-days' drift of the ferry-boat down the river in May and June, 1900, as also the routes of two canoe-trips undertaken from two fixed camping-places to the Karaunelik-Kul and the Ullugh-Kul.

By far the most conspicuous features on Plate 12, are the numerous elongated, and in part parallel, lakes lying close to one another on the right bank of the Tarim, and all of them fed by small canals from the river. According to the information I collected, these lakes number no less than thirty-five; but out of these I did not investigate more than six, a quite sufficient number, however, seeing that they are so like one another. Their dimensions, which are not very great, are shown in the following table :—

Name.	Length in km.	Max. breadth in m.	Min. breadth in m.	Mean breadth in m.	Area in square m.	Max. depth in m.	Mean depth in m.	Volume in cubic m.
Bash-Kul	15·9	2000	1000	1345	21,000,000	—	—	—
Yanghi-Kul ...	13·35	1508	965	1244	15,000,000	—	—	—
Gulme-Kuti ...	8·0	2500	1000	1662	13,794,000	7·0	—	—
Karaunelik-Kul	5·2	2000	3000	1125	5,850,000	9·4	5·61	32,800,000
Ullugh-Kul ...	7·35	3200	—	—	14,860,000	10·0	4·92	69,500,000
Beghelik-Kul ...	11·6	4150	—	—	30,000,000	11·0	3·67	110,000,000

I have endeavoured to prove that the origination of these lakes is one of the causes of the shrinking of the Kara-koshun, a process which has been constantly going on during the twenty-five years that elapsed between Prjevalsky's first visit and my last visit.

Another circumstance, quite as peculiar and unexpected as the regular configuration of the lakes, is the fact that they are very considerably deeper than the parts of the river adjacent, so that on the right bank of the Tarim there is a whole series of depressions stretching from north-north-east to south-south-west, the lakes thus lying at right angles to the river. The entire system resembles a branch with its leaves attached, each lake-leaf hanging on to the stem by a short stalk. From the table above, it will be seen that the maximum depth of the four lakes sounded increases downstream, that is from west to east, but that the mean depth grows less, and is smallest in the most easterly of the lakes measured, namely the Beghelik-Kul, which is situated outside of the edge of Plate 12. But this must be a pure accident due to the insufficient number of soundings taken. In the Beghelik-Kul I took soundings at eighty-eight points, or three points in every square kilometre. But the feature which stands out with the sharpest distinctness in this series of soundings is the extraordinary regularity in the relief of the lake-bottom, and for our present purpose that is the principal thing. For instance, we ascertained that the greatest depths in all the lakes occur near their eastern shore, and the contours gradually rise towards the west. The very first glance I took at these lakes led me to suspect that the relief of their several basins must be of this character. For the eastern shore of each lake is overhung by the steep (33°) leeward slope of a dune-accumulation—that is, a heaping up of individual dunes into a compound mass—but on the west or windward side the surface slopes slowly up to the crest of the next dune-accumulation, while over on the western side of it there is yet another lake.

With the levelling-mirror I measured the height of the dune-accumulation which separates the Karaunelik-Kul from the Toghraklik-Kulning-dashi (the last named, being cut off from the river, contained salt water), and found that its culminating point was 89·5 metres (294 feet) above the surface of the Karaunelik-Kul. Other measurements convinced me that the highest crests have in general an altitude of about 90 metres (300 feet), and this may be regarded as the limit beyond which the dunes in this region do not rise. It is at this altitude that the tendency of the dunes to increase in height is counterbalanced by the wind's transporting power.

My journey across the desert of Cherchen, a journey of 177 miles in length, proved to me that these gigantic ridges of sand stretch diagonally across almost the entire desert all the way to the Cherchen-daria; and at the Ettek-tarim I found that they begin on the very bank of the stream, or on the extreme eastern boundary of the desert. It is, however, in the northern part of the desert that the dune-accumulations or sand-ridges are most powerfully developed. In the desert of Cherchen the sand is arranged in waves, presenting the same appearance as the waves of an ocean across which a hard and steady wind is blowing.

At first it struck me as strange that these sand-ridges in the extreme north of the desert should run towards the south-west, and then gradually incline towards the south-south-west and south, until upon reaching the Cherchen-daria they stretch towards the south-south-east, thus describing arcs of circles. But I believe I have discovered the cause why the sand-ridges assume these directions. The greatest difficulty was to understand how it is possible for the storms of inconceivable violence (60 miles an hour at the surface of the Earth) which sweep, especially in spring, across the country of Lop and the adjacent regions, can arrange the sand-accumulations in such a way that the direction of the wind and the crest of the dunes form an acute angle with one another, because the natural expectation is that the wind must of necessity strike the crests of the dunes at right angles. It is only in the extreme south of the desert, where the dune-accumulations stretch towards the south-south-east, that this necessary physical law appears to be fulfilled. There must, of course, be a special reason for the apparent anomaly in the northern part of the desert. Upon noticing carefully the orientation of the individual dunes, I found that their crests do lie as I expected them to do, namely, at right angles to the wind. The explanation I have to offer of the anomaly to which I have called attention is this: assuming that the strength and direction of the wind are the same throughout the whole of the desert, then the deviation of the sand-ridges from the normal—that is to say, their curved shape—is due to the fact that the mass of sand in the northern dune-accumulations is greater than the mass of sand in the dune-accumulations in the south of the desert, so that the dunes in the south travel faster than those in the north. The consequence is, that the winds in the northern part of the desert strike the long axis of the dune-accumulations at an acute angle. Of course the curves which these sand-ridges describe are not perfectly regular, but, as a rule, the angle may be said to increase from north to south; for instance, in *bajir* No. 1 it is 28°, and in *bajir* No. 4 87°, or as near as possible a right angle.

In between these stupendous waves of sand, built up by the remarkably constant east-north-east winds, which bring their materials from the disintegrated and crumbling Kuruk-tagh, there exist hollows or kumatic valleys, *i.e.* chains of depressions, parted from one another by comparatively low thresholds of sand. Each such depression—some of them are shown on Plate 12—is called by the natives a *bajir*, and forms a small self-contained basin, with a clay bottom, and is surrounded by sand, steep on the east side, and with a slow ascent to the next crest on the west. The lakes on the right bank of the Tarim are nothing but *bajir* depressions of this character, which by pure chance have become filled with water. The chance in question is that in former times the Tarim flowed due east along the bed of the Kuruk-daria, and emptied itself into the ancient lake of Lop-nor, but subsequently changed its direction to the south-east, washing away incalculable masses of sand from the desert. And the river is still at the present day continuing its destructive work—that is to say, it is travelling farther and farther towards the right, towards the south-west, breaking down and transporting the projecting ends of the sand-ridges, pushing itself farther and farther into the desert, levelling it down as it advances. An excursion by boat along this part of the river is extremely interesting, and offers a succession of grand and picturesque views. Time after time the river-loops penetrate southwards deeply into the high sand; dune-masses, 300 feet high, shoot straight down into the water at an angle of 33° from the right bank. The question arises, How is it possible that the dunes can be so steep just there, where they turn their broken ends to meet the predominant winds, for one would naturally expect those slopes to be extremely flat? The explanation is simply this—that the river keeps moving incessantly towards the south-west. On the one hand, the wind labours to make the upper layers of the dune-masses flatter and flatter, while on the other hand, the river keeps breaking down the base of the dunes and washing the sand away, thus preserving their steepness; and as the river is the stronger its effects prove the more permanent.

The lakes, however, offer no hindrance whatever to the advance of the dunes. The table above shows that their capacities are insignificant as compared with the volumes of the dune-accumulations. In spite of the lakes, the masses of sand continue their slow advance towards the west.

One of the clearest proofs that the dune-accumulations do travel is afforded by the characteristic shape of the lake-basins. The same shape occurs again in each and every one of the numerous bajir depressions of the desert—that is to say, they are always deepest at the base of the steep leeward face of the dune-masses which rise on the east side of the depressions. It is this part of the basin which has for the longest time been exposed to the effects of corrasion and deflation—that is to say, to the excavating activity of the wind. The western side of the bajir is less deeply excavated, because it is relatively quite recently that the lowest part of the windward side of the westward dune-accumulation was swept off it. The bajir depressions themselves thus travel westwards along with the dune-accumulations. Whilst the dune-accumulations themselves maintain their individuality, altering their form but very slightly and very slowly, the bases upon which they stand are successively renewed after the lapse of countless centuries. But by the time they reach the Keriya-daria and the route I followed across the desert from the extreme northern tentacle of that river to the Tarim in February, 1896, they have entirely disappeared. The cause of their disappearance is, of course, the less degree of regularity and constancy shown by the winds in the western parts of the desert as compared with those in the country of Lop. In the desert of Takla-makan I did not observe a single trace of the almost unparalleled regularity that characterizes the desert of Cherchen.

A great part of vol. i. of 'Scientific Results' is occupied with the problems which I have here briefly indicated, and I have endeavoured to support my views with numerous diagrams and photographs. Possibly some of my views may appear rather bold, but such as they are I leave them to my critics to deal with. Several of the problems discussed in this connection can only be definitely explained and illustrated in vol. ii., after I have described the relief of the desert of Lop. This desert is grooved by countless gullies, 1 to 3 metres deep, and separated from one another by long clay ridges called *yardangs*, extending in a direction parallel to that of the prevailing wind, which blows here from the north-east, though in the northern part of the desert it comes even from the north-north-east. In this part of Asia it is the wind which, with dictatorial power, controls the surface of the Earth and determines its configuration; not only does it heap up the drift-sand in a manner which for regularity is unparalleled in any other part of the world, and wear down the clay desert by corrasion, but it also causes the river to change its course, and the lakes to migrate; when the lake of Lop-nor became filled with drift-sand and fluviatile sediment, the river shifted so as to flow into the basin of the Kara-koshun. Whilst this southern basin, which at the present time has a mean depth of barely 1 metre, is being filled up with solid material, the wind is continuing its excavating activity in the dry basin of the Lop-nor, and some day—I can predict it with almost mathematical certainty—the waters of the Kara-koshun will return there.

All I wished to say, however, is that vol. i. and vol. ii. are in every respect very intimately connected together, as indeed might naturally be expected, seeing that they are both concerned with the Lowlands, or the vast basin of Central Asia.

At the present moment I am engaged upon vol. iii., which deals with Northern and Eastern Tibet, while in vol. iv. I shall describe Central and Western Tibet. The last route I have to describe is that from Leh to Kargalik *viâ* the Karakorum pass. These two volumes will have two common indexes, one of names, the other of subject-matter, printed at the end of vol. iv. With regard to the treatment in the two volumes about Tibet, I will merely say here that my main object is to give a description, in diarial form, of the geography of the region I travelled through, the descriptive text thus running parallel to the sheets of the atlas, and describing their features in chronological order. This detailed description will, however, be followed by a general geographical survey of the relief of the Tibetan highlands, their orographical system and absolute altitudes, their self-contained basins and lakes. I hope, from the material I have collected, to be able to give a tolerably faithful picture of the morphology of Tibet. Vol. iii. and vol. iv. will be very profusely illustrated, and will afford a good opportunity of studying Tibetan mountain scenery in lithographic pictures of exceptional beauty.

Finally, summing up what I have already said above, I ask for indulgence for the great defects which unavoidably attach to my work. Had I been able to take with me a large staff of scientific associates, as my friend and countryman Otto Nordenskjöld did, the results would have been more copious; but somehow I like to work alone, and I always have worked alone. Certain parts of my journeys, such as the excursions across the deserts and my advance towards Lhasa (Lassa), were not unattended by a certain amount of peril, and I should hardly have been justified in venturing upon such forced marches had I had the lives of colleagues to answer for. The escort of Cossacks which the Russian Emperor placed at my disposal were ready to lay down their lives for me, a degree of self-sacrifice which is seldom found in those whom in everyday language we call associates and comrades.

Mommsen has somewhere said, speaking of himself, that he was only a child playing with stones on the shore of the ocean of knowledge. What shall I call myself, then? A child who has not even yet seen the immeasurably distant horizon of that same ocean, nor done more than glance at its immense expanse. But the experiences and observations which I have made in the course of my toilsome marches towards that wondrous shore, I herewith offer to the students of geographical exploration, in the hope that my labours have not been altogether in vain.

BATHYMETRICAL SURVEY OF THE FRESH-WATER LOCHS OF SCOTLAND.*

Under the Direction of Sir JOHN MURRAY, K.C.B., F.R.S., D.Sc., etc., and LAURENCE PULLAR, F.R.S.E.

PART VI.—THE LOCHS OF THE EWE BASIN.†

IN this paper it is proposed to deal with the lochs visited by the Lake Survey draining into Loch Ewe, viz. Loch Maree, Lochan Fada, Lochs Garbhaig, Coulin, Clair, Tollie, Kernsary, Ghiuragarstidh, Mhic' Ille Riabhaich, a' Bhaid-Luachraich, Sguod, an t-Slagain, and an Drainc. The two last-mentioned lochs fall into the sea just outside the entrance to Loch Ewe, but it has been found convenient to include them with the lochs of the Ewe basin. The relations between the various lochs will be readily grasped by reference to the small index map of the district shown in Fig. 1. The drainage area under consideration extends from the mouth of Loch Ewe to the summit of Carn Odhar in the south, and close to the shores of Loch Fannich in the east, and is about 30 miles in length from north to south, and about 17 miles in maximum width from east to west. The total area is about 220 square miles (excluding Loch Ewe), and, as will be seen from the table at the end of this paper, about 185½ square miles drain into the lochs now to be dealt with, leaving about 35 square miles draining into the sea irrespective of these lochs. The head-waters of the basin on the south take their rise on the flanks of Beinn Liath Mhor and Carn Breac, flowing by the river Coulin into Loch Coulin, thence into Loch Clair, thence by the Allt Ghairbhe into the Kinlochewe river, at Kinlochewe, which falls into Loch Maree at its head. A short distance along the north-eastern shore Loch Maree receives the outflow from Lochan Fada by the Abhuinn an Fhasaigh, and, still further down, the outflow from Loch Garbhaig ‡ by the Amhainn na Fuirneis. At its foot Loch Maree receives the outflow from Loch Tollie on the west, and from Lochs Ghiuragarstidh and Kernsary on the north-east, and its waters are carried by the river Ewe into the head of Loch Ewe. The outflow from Loch Sguod falls into Loch Ewe on its western shore, and the outflow from Lochs Mhic' Ille Riabhaich and a' Bhaid-Luachraich on its eastern shore. Loch an t-Slagain flows into Slaggan bay at the entrance to Loch Ewe, and Loch an Drainc flows into The Minch a short distance to the west of the entrance to Loch Ewe. A number of small lochs within the district now being dealt with could not be surveyed for lack of boats.

The geology of this district is described by Drs. Peach and Horne, their important contribution appended to this paper being illustrated by a special geological map.

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* Plates, p. 616.

† In the preparation of this paper the field-notes of Mr. T. R. H. Garrett, B.A., were chiefly made use of.

‡ The smaller Loch Garbhaig lying to the west of Loch Maree was not sounded.

Loch Maree (see Plates I. and II.).—The loch derives its name from Saint Maelrubha, who in 671 A.D. left Bangor, and after founding one church at Applecross, founded another on Isle Maree. It is the largest sheet of fresh water in Scotland north of Loch Ness, and trends in a north-west and south-east direction.

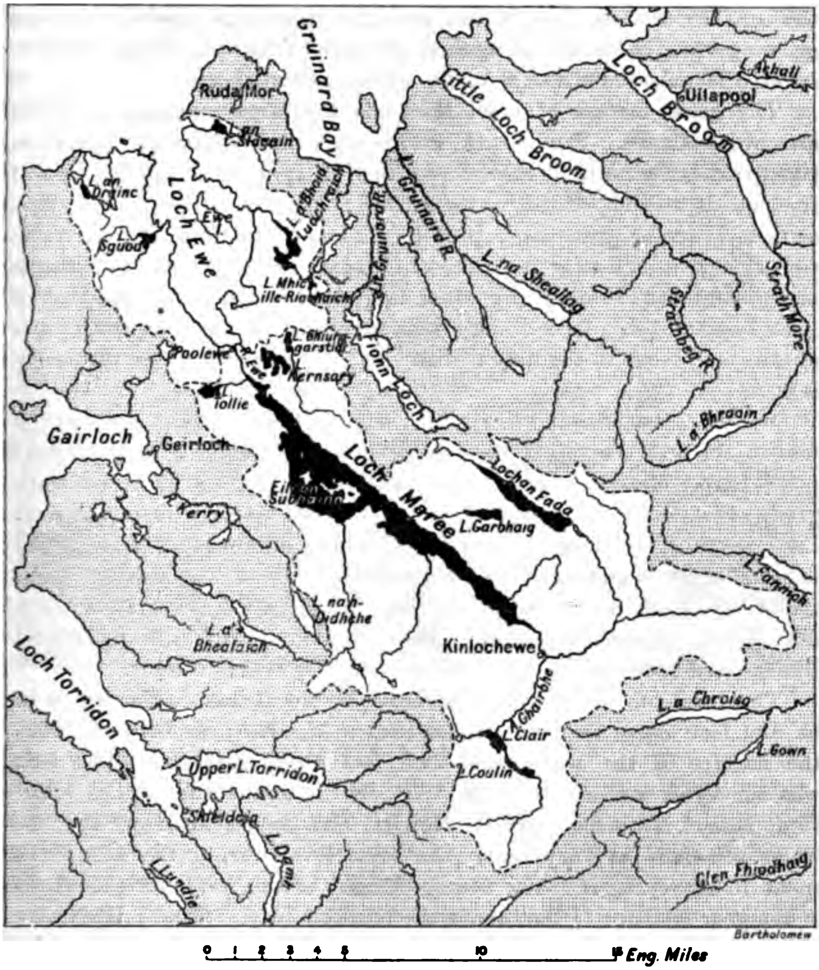

FIG. 1.—INDEX MAP OF THE MAREE DISTRICT.

On the north-east side of the loch, and parallel to it, runs a grand series of mountains—Beinn Airidh Charr, Meall Mheannidh, Beinn Lair, Slioch, Sgurr an Tuill Bhain and Beinn a Mhuinidh; the slope for the first 1000 feet all along this north-eastern shore is very steep, in many places exceeding 45°. To the south-west rise Beinn Eighe, Beinn a Chearcaill and Beinn an Eoin; the sharp ridge of the former, composed of white quartzite, forms an especially fine object from the loch to the north of the Gruididh. But the two most striking features of Loch Maree are Slioch and Isle Maree; the huge sugar-loaf form of Slioch is conspicuous from almost every part of the loch, and, though one of the smaller islands, Isle Maree, owing to the large number of trees growing upon it, stands out against the dark background of the heather-covered islands and the cliffs of the north-eastern shore.

The great feature of Loch Maree is the large number and great area of its islands. Prof. Penck, in his work on the Lake of Constance, lays great stress on the "insulosity," *i.e.* "the proportion of the area of the islands to that of the water surface;" this in Loch Maree is 0·09, or three times as great as that of the Lake of Cheim (0·03), and nine times as great as that of the Lake of Constance (0·01). Its insulosity is also greater than that of any other large lake in Great Britain, that of Loch Lomond being 0·08, though it is surpassed in this respect by one of the small lochs in the Assynt district (Loch Cròcach, whose insulosity is 0·091).

Many of the islands were joined together when the Lake Survey visited the loch owing to the low level of the water. A few small rocks and reefs occur out in the channel to the north of the main group of islands and removed some considerable distance from the rest. Large numbers of the Lesser Black-Backed Gull (*Larus fuscus*) breed on the larger islands, and two pairs and young of the Greater Black-Backed Gull (*Larus marinus*) were observed on two of the smaller islets. Isle Maree, Eilean Ghruididh, Eilean Subhainn, and Eilean Ruairid Bheag have been used at one time as fortresses or habitations.

The level of Loch Maree was found by the Ordnance Surveyors to be 32·1 feet above sea-level on September 15, 1870; on July 16, 1902, the surface of the water was 29·5 feet above sea-level. The loch was surveyed on July 16 to 24, 1902, by Sir John Murray, Dr. Johnston, Messrs. Parsons, Garrett, Hewitt, and James Murray, and the water remained at very nearly the same level during the nine days spent in surveying it. The average height of the water for the whole of the year is about 1½ feet above the level on July 16, 1902; the water has been known to rise 9 feet higher and to fall 1 foot lower than the level on this date.

Before dealing with the statistics of Loch Maree, it is necessary to state that there has been included in the loch a large portion of the piece of water styled "River Ewe;" soundings were taken in the so-called river, and depths of over 30 feet were obtained in places down to beyond the commencement of the Pool Crofts. Just above the partly artificial dam depths of 37 and 35 feet were obtained, and these would seem to point to the fact that down to here the "river" is nothing more than an arm of the loch, with a current flowing along it to the outfall. That this place is the beginning of the river was evidently the opinion in past time, for it was here that the old iron-workers built their dam to obtain water for working "A Cheardach Ruardh" (The Red Smiddy).

The length of the loch as thus defined is 13½ miles, and the maximum breadth rather over 2 miles. The mean breadth is nine-tenths of a mile, being 7 per cent. of the length. Its waters cover an area of over 11 square miles, and the islands nearly 1 square mile. Loch Maree has a large shore development, *i.e.* the length of the shore line is much greater than the circumference of a circle whose area is equal to that of the loch. The shore development is 3·15, being greater than that of any other large loch in Scotland. The drainage area is 171 square miles, or 15 times the area of the loch.

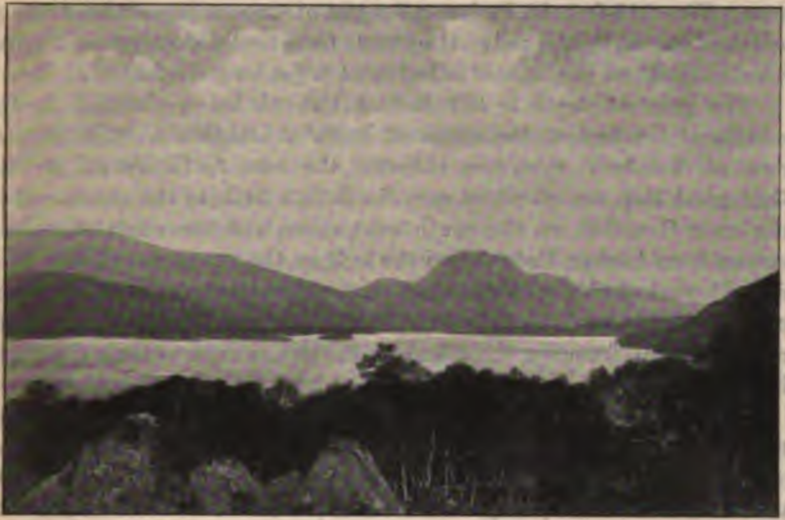

FIG. 2.—LOCH MAREE, THE ISLANDS IN THE MIDDLE DISTANCE.
(*Photo by J. A. Harvie-Brown, F.Z.S.*)

Twelve hundred soundings were taken in Loch Maree, and the greatest depth obtained was 367 feet, in the middle of the loch to the south-west of Rudh' a' Ghuibhais; the bottom of the loch here is thus 337½ feet below sea-level. The volume of water is estimated at over 38,500 millions of cubic feet, and the mean depth at 125 feet (34 per cent. of the maximum depth). The breadth of the loch at the position of the deepest sounding is seven times the depth.

Loch Maree is divided into three main basins—(1) that extending from Isle Maree to the south-east end of the loch, which may be called the "Ghruididh basin;" (2) that lying to the south of the islands, which may be called the "Slattadale basin;" and (3) that extending from the north-east of Eilean Ruairid Mòr to the north-west end of the loch, which may be called the "Ardlair basin."

(1) The Ghruididh basin. This basin is the largest and deepest of the three. The 200-feet area extends from a quarter of a mile to the east of Isle Maree to about half a mile from the south-east end of the loch, and has a length of 6¼ miles, its average width being about three-quarters of a mile. The main 300-feet basin has a length of 2 miles and a mean breadth of about a quarter of a mile; it extends from south of Coppachy to north of milestone 3 miles from Kinlochewe. There is another smaller 300-feet area a little to the north-west of the main area. The 350-feet basin has a length of one mile and an average width of one-sixth of a mile; it extends from north of milestone 5 miles from Kinlochewe to north of milestone 4 miles from Kinlochewe.

The greatest depth is 367 feet, this depth being obtained in the middle of the loch to the south of Rudh' a' Ghuibhais. The deepest part of the loch thus lies between the two faults shown on the Geological Map, one of which cuts the loch a little to the south-east of the river Gruididh on the south-west shore, and the other where the stream from Lochan Fada enters the loch on the north-east shore. The deepest part of this whole basin occurs where the great mass of Slioch on the one side, and the heights of the Kinlochewe Forest on the other, rise steeply up from the shore and, as it were, compress the valley into its narrowest limits.

This basin has a typical "cauldron shape," which is brought out in the section on the map, the slope on both sides down to the 350-feet contour-line being one of 26½°; the flat portion in the middle is about 300 yards broad at the deepest place. The slope up to the 1000-feet contour-line is one of 24½° on the north-east shore, and one of 14° on the south-west shore.

It should be noted that the floor of the loch rises steeply where the second fault alluded to cuts it, that part of the loch lying to the south-east of this fault being very shallow. This feature is also seen where the same fault cuts the east end of Lochan Fada.

In Loch Maree a large number of the streams have formed very decided alluvial cones; *e.g.* the large one at the mouth of the Ghruididh river. This feature is much more marked in Loch Maree than in the majority of lochs. Other features of interest in this basin are the comparatively deep soundings in Ob nam Muc and the inlet to the south-east of this; and the curious hill on the bottom of the loch to the south of Letterewe (300 yards from the shore), the summit of which is covered by 44 feet of water.

(2) The Slattadale basin. This basin extends from west of Eilean Ruairid Mòr to south of Eilean Subhainn. The 150-feet area has a length of 2 miles and a mean breadth of a quarter of a mile. The curve

traced out by this contour to the east of the Slattadale river is very remarkable; the extension of the shallower part of the loch into the 150-feet area is in the direction of the Slattadale river, but the soundings nearer to the shore give no indication that this bank is due to the material brought down by the river. The 200-feet area extends from south of Eilean Ruairid Mòr to north of Stalla nam Manach, its length being nearly 1½ miles, and its average breath about 150 yards. The greatest depth is 232 feet in the extreme north-west of the basin. In a line with the curious indentation in the 150-feet contour-line the 200-feet basin is very narrow and shallow (202 feet).

Comparatively deep soundings were obtained in all the channels extending into the islands, and it is noteworthy that the long and narrow passage between Eilean Subhainn and Garbh Eilean lies in a line with the narrow prolongation of deeper water from Rudha Chailleach into the shallow water north of the islands.

Ob na h-Innse Moire in Eilean Subhainn was cut off from the main part of the loch by a sand-bar. This was also the case with the inlet to the north-west of Ob na h-Innse Moire, but this inlet had its surface covered with weeds and boulders.

(3) The Ardlair basin.—The outline of this basin is also very irregular, and the bottom more so than in either of the other basins. The 100-feet area has a length of 3¼ miles and a mean breadth of three-quarters of a mile. The 200-feet area has a length of 2¼ miles and an average breadth of one-third of a mile. The length of the 250-feet basin is two-thirds of a mile and the average breadth a quarter of a mile. The greatest depth in this basin is 285 feet, occurring about 700 yards to the south-east of Rudh' Aird an Anail.

In this basin the contour-lines run very close to the north-eastern shore in the western and central parts of the basin, but spread out towards the eastern part. Again, they run very close to the shore round the western coast of .Eilean Ruairid Mòr and round Rudh' Aird an Anail. They have a very sinous outline in the eastern part of the basin.

As stated above, the floor of this basin is very irregular; several small hills rise above the general level of the bottom, as that to the south of Ardlair and that to the east of Rudh' Aird an Anail. The north-western extension of this basin, called " River Ewe," has already been noticed.

There remain for consideration the ridges between the basins and the large tract of shallow water to the north of the islands. The ridge which runs across from Eilean Ruairid Mòr to the mouth of Allt na Doire is very marked. The lowest part of the ridge is 83 feet below the surface of Loch Maree, whilst the distance between the two 100-feet contour-lines at this place is 120 yards, and that between the two 150-feet contours is 550 yards.

The shallow water to the north of the islands is much more remarkable. A large part of this area is under 50 feet in depth, and the deepest water that occurs anywhere between Creag Tharbh and Rudha Chailleach is 79 feet, though it is along this northern channel that the great fault must run. Right in the middle of the channel, underneath Creag Tarbh, the water is only 41 feet in depth; the hills on the north shore rise steeply up to heights of over 2000 feet in places, and the slope up to the 1000-feet contour-line is at an angle of 45°; hence the difference between the sub-aerial and the sub-aqueous slopes is in this place very marked. Rudha Chailleach (the witch's point) is a narrow spit of shingle stretching out to a considerable distance into the loch, with deep water close to the shore. From this point a narrow channel of deeper water projects right across the loch towards the opening between Eilean Subhainn and Garbh Eilean.

The ridge between the Slattadale and Ghruididh basins is merely a continuation of the islands. The depths on it are much less than on either of the other ridges; there is, however, a fairly deep channel, through which the steamer passes, ranging in depth from 62 feet to 28 feet; this channel is narrowest and shallowest between Isle Maree and Eilean Eachainn. To the south of Isle Maree is a large sand-flat, which in July, 1902, was covered by less than a foot of water, and on which were many boulders rising above the surface of the water.

The areas between the consecutive contour-lines, and the percentages to the total area of the loch, are as follows :—

Feet.	Acres.	Per cent.
0 to 50	2090	29·6
50 „ 100	1283	18·2
100 „ 150	1066	15·1
150 „ 200	877	12·4
200 „ 250	977	13·9
250 „ 300	412	5·8
300 „ 350	254	3·6
Over 350	99	1·4
	7058	100·0

It will be observed that the zone between 200 and 250 feet is larger than that between 150 and 200 feet, otherwise the areas between the contour-lines drawn in at equal intervals decrease gradually with increase of depth.

The Small Loch on Eilean Subhainn.—Apparently this loch has not been considered important enough to receive a name, but the fact that it had the appearance of being of some depth, whereas the other lochs on the islands in Loch Maree are overgrown with weeds or moss, induced the Lake Survey to sound it. The trouble taken was well repaid by the curious nature of the bottom revealed by the soundings.*

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* The method of sounding out this loch is interesting: it was found impossible to transport a boat to the loch, and Mr. Garrett took soundings by hand while swimming.

Eilean Subhainn is 292½ acres in area, its shore-line being very irregular. The surface of the ground is uneven, though nowhere except in the south-east corner is it very elevated; here, however, a small hill rises to a height of 84 feet above the level of Loch Maree. The greater part of the island is not more than 30 to 40 feet above Loch Maree, this rise for the most part taking place in the first 30 yards, and in some places there are vertical cliffs from 20 to 30 feet in height. In these cliffs it is seen that the island is composed of Torridon sandstone; the rock does not appear elsewhere except around the little loch, the island being covered with peat with a considerable number of fir-trees round the shore and in the south-east corner.

The loch lies in a small hollow in the centre of the island, being situated about a quarter of a mile from the south-east shore, and one-third of a mile from the west shore of the island, and about 150 yards from the Lily Loch. Its level was determined on July 24, 1902, to be 57·4 feet above sea-level, and 27·9 feet above the surface of Loch Maree.

The loch trends in an east and west direction, and its length is a little over 250 yards; its maximum breadth is about 100 yards, and the mean breadth about 70 yards. Its waters cover an area of nearly 5 acres, and its drainage area is ten times greater, or 51 acres; the shore development is 1·62 and the insulosity 0·02. The maximum depth is 64 feet, and hence the bottom of the loch is 30 feet below the level of Loch Maree, and 6½ feet below sea level. The volume of water contained in the loch is estimated at 6 millions of cubic feet, and the mean depth at 46½ feet.

The loch is fairly regular in outline, and has three small islands in it. The deepest part is a mere hole near the western end; on the ridge running across from the island near the north shore to the island with the tree there is only 5 feet of water, but there is a considerable depth of mud. In the eastern part of the loch depths of 12 feet were met with. Eighty-five per cent. of the total area of the loch is less than 50 feet in depth. This loch is the only one situated on an island in another loch, which has been visited by the Lake Survey. It was surveyed on July 24, 1902, by Messrs. Parsons and Garrett.

Temperature Observations.—Many surface temperatures were taken in Loch Maree between July 16 and 24, 1902, the greatest range observed being from 53°·3 off Letterewe at 11 a.m. on the 21st, to 57°·0 at Talladale at 7 p.m. on the 22nd. The surface temperature in the south-east end of the loch was almost always higher than that in the north-west end, owing to the north-west winds prevailing during the time the Lake Survey was on the loch. For instance, on July 19 the temperature of the surface north-west of Rudh' Aird an Anail was 53°·9 at 3 p.m., and off Ardlair it was 54°·0 at 4 p.m., whilst at 3.15 p.m. it was 55°·3 to the south-east of Fhasaigh.

Five serial observations were taken on July 19 and 21, as given in the following table :—

Depth in feet.	Loch Maree, opposite Pool Crofts, July 19, 1902, 12 noon. No wind; air-temperature, 54°·0.	Loch Maree, S.W. of E. Ruairid Mòr, July 19, 1902, 6 p.m. Stiff N. breeze; air-temperature, 53°·7.	Loch Maree, opposite Letterewe, July 21, 1902, 12.45 p.m. Air-temperature, 51°·6.	Loch Maree, N. of E. Ruairid Mòr, July 21, 1902, 1 p.m. Light N.W. breeze; air-temperature, 53°·5.		Loch Maree, off Rudh' a' Ghiubhais, July 21, 1902, 6 p.m. Moderate N.W. wind; air-temperature, 54°·[illegible].
	°	°	°	°	°	°
0	53·5	54·7	53·9	53·9	53·9	54·5
5	- -	- - -	53·8	—	—	54·2
7	- - -	- -	—	—	—	—
10	—	-	53·6	53·7	53·7	54·2
15	53·6	54·7	53·5	53·3	53·4	—
20	—	—	53·5	—	—	54·2
25	—	54·0	—	53·5	53·7	—
30	53·6	—	53·3	—		54·0
35	- -	- - -	—	53·2		—
50	- -	53·0	53·1	53·0		54·0
75	- -	50·0	50·8	50·3		53·6
80	- -	- - -	—	—		—
85	- -	- - -	—	—		49·6
100	-	48·0	49·0	48·2		48·0
150	-	48·1	46·9	46·6		46·4
200	-	47·0	45·9	46·0		45·9
250	- -	—	45·4	—		—
300	- -	- -	- -	—		45·6
350	-	- -	- -	—		45·5

Below the surface the fall in temperature was slow down to about 50 feet, when the fall became very rapid down to 150 feet, and then slow again to the bottom. Though these are the characteristics of the three series taken on the 21st, that taken on the 19th to the south of Eilean Ruairid Mòr in the Slattadale basin does not agree with the others. In this case there was a rapid fall from 20 to 100 feet, and then a slight rise in temperature to 150 feet, and then a slow fall again to 200 feet.

The series taken to the north of Eilean Ruairid Mòr on the 21st is interesting on account of the decided inversion at 25 feet. Though these inversions of temperature have occasionally been observed, they are by no means common. In this case it was noticed that the temperature fell from 53°·9 at the surface to 53°·7 at 10 feet, and to 53°·3 at 15 feet, and then rose to 53°·5 at 25 feet, and then fell again steadily below this depth. The series down to 25 feet was repeated with the results shown in the second column under this head, which proved that the inversion, though small, was real and not due to the instrument.

Lochan Fada (see Plate III.).—Lochan Fada (*i.e* the long loch) is the largest of its name. It is situated about 3 miles to the north-east of the upper end of Loch Maree, and runs parallel to it for a distance of 4 miles. The scenery around Lochan Fada is of the most magnificent description, Slioch and Beinn Lair overlooking it on the south-west shore, and Beinn Tharsuinn and A Mhaighdean on the north-east shore. The ridge between Lochan Fada and Gorm Loch Mòr is particularly noticeable; the rise from the loch is 750 feet in 350 yards, and the top of the ridge is exactly like a knife-edge. The crags on the south-west shore are very bold and wild, being composed of the Beinn Lair sill of hornblende-schist, and extend from between Lochan Fada and Loch Garbhaig to south of Loch Fionn. When standing above the north-west end of the loch, the outlet to the south is not suspected; the loch appears to drain away down the continuation of the glen into Glen Na Muic. Doubtless at one time this was the outlet of the loch, for the col here between Lochan Sgeireach and Loch Gleann na Muic is only 13 feet above the level of Lochan Fada. But Abhuinn an Fhasaigh, having a much shorter course than Abhuinn Gleann na Muic, has been able to cut back much more rapidly, and perhaps all the more so since its course lies along the line of fault, which runs from Loch Meallan an Fhudair to Loch Maree, and has tapped Lochan Fada, slightly lowering its level, thus beheading Abhuinn Gleann na Muic.

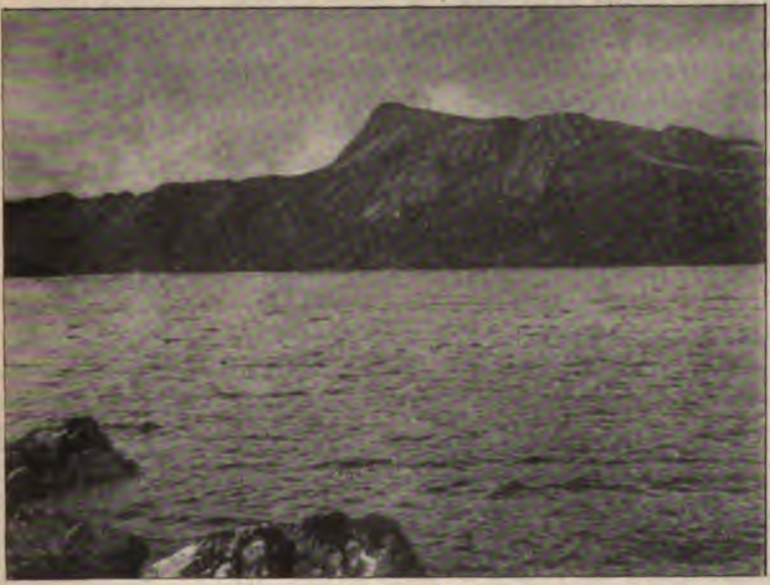

FIG. 3.—LOCHAN FADA, LOOKING NORTH, SHOWING RIDGE.
(*Photo by T. N. Johnston, M.B., C.M.*)

The height of the loch above sea-level was not determined by the Ordnance Survey, nor by the Lake Survey, owing to absence of bench-marks, but, judging from the spot-levels, and the 1000-feet contour-line, its level must be about 1005 or 1006 feet above the sea.

The length of Lochan Fada is 3¾ miles, and its maximum breadth nearly two-thirds of a mile; the mean breadth is over one-third of a mile. Its waters cover an area of nearly 1½ square miles, and it drains an area 6½ times greater, or over 9⅓ square miles. The maximum depth is 248 feet; this occurs in the centre of the loch off the mouth of Allt Meallan a' Chruidh. The mean depth is estimated at 102 feet, and the volume at 4091 millions of cubic feet. The breadth of the loch at the position of the deepest sounding is twelve times the depth. The shore development is 2·16, and the insulosity is *nil;* Lochan Fada, like so many of the larger lochs, has not a single island.

The bottom of Lochan Fada is very regular, the 50-feet and 100-feet areas being continuous, and extending almost from one end of the loch to the other. The main 150-feet area extends from west of Claona to the narrower part of the loch, and has a length of 1½ miles; there is a small 150-feet area near the south-east end of the loch. The 200-feet area extends from south-west of Claona to west of Allt na Botaig; its length is one mile, and average width 280 yards.

The areas between the consecutive contour-lines, and the percentages to the total area of the loch, are as follows:—

Feet.	Acres.	Per cent.
0 to 50	230	25·0
50 „ 100	236	25·7
100 „ 150	263	28·7
150 „ 200	100	10·8
over 200	90	9·8
	919	100·0

It is unusual to observe, on proceeding from the shore into deeper water, an increasing area between the contour-lines drawn at regular intervals, as in the case of Lochan Fada, and indicates an average steep slope near shore. A glance at the map shows that the 50-feet contour follows closely the outline of the loch, and in places approaches very close to the shore.

Seiche.—On July 28, beginning at 1 p.m., a well-marked seiche was observed in Lochan Fada in a sheltered bay at the south-west end of the loch; the wind was strong from the west. The amplitude was half an inch, and the period about 11·6 minutes; but this oscillation was so broken up by two other oscillations, whose periods were about 2½ minutes and 1 minute respectively, that the whole effect was extremely complicated, and no calculations could be made from the observations.

The loch was surveyed on July 25 to 28, 1902, by Messrs. R. M. Clark, B.SC., and James Murray.

Temperature Observations.—The temperatures taken in Lochan Fada are extremely interesting, because they indicate a much lower temperature than was observed in any of the other lochs in the district at the same time of the year, as shown by the following series taken at 6.40 p.m., on July 28. 190 [illegible] th of Allt Meallan a' Chruidh :—

Surface	51°·1 Fahr.
10 feet	51°·1 „
20 „	51°·1 „
50 „	51°·0 „
75 „	45°·8 „
100 „	45°·0 „
150 „	44°·3 „
220 „	44°·1 „

This series indicates an almost constant temperature down to 50 feet, then a fall of 5°·2 between 50 and 75 feet (a fall exceeding 1°·0 per 5 feet of depth), and then a slight decrease of 1°·7 down to the bottom in 220 feet. Compared with the larger and deeper Loch Maree, the water in Lochan Fada was found to be colder at all depths than that in Loch Maree: thus the surface of Lochan Fada had a temperature about 3½° lower than was observed in the surface waters of Loch Maree a week earlier, and at the bottom of Lochan Fada, in 220 feet, the temperature was found to be about 1½° lower than at the bottom of Loch Maree in 350 feet. This is probably due to the fact that Lochan Fada is very deep, considering its area, and therefore a large volume of water has to be warmed, while only a comparatively limited area is exposed to the heating agencies.

Loch Garbhaig (see Plate I.).—Loch Garbhaig lies between Lochan Fada and Loch Maree, about half a mile from the former and 1½ miles from the latter. It drains into Loch Maree by the Amhainn na Fuirneis, which leaves the loch at its western end, and, flowing in a westerly direction, enters Loch Maree between Furness and Letterewe. The ground at the eastern end is not much elevated above the surface of the loch, the col leading over to Lochan Fada, but on the south side Slioch rises up from the shore to a height of 3200 feet, and on the north side the high ground to the east of Beinn Lair rises to over 2500 feet. The most noticeable feature of the surrounding country is its bareness. The height of the loch above the sea was not determined by levelling when surveyed by Dr. Johnston and Mr. Hewitt on July 25, 1902, but from the contour-lines the level is probably between 1005 and 1015 feet.

Loch Garbhaig is over a mile in length, with a maximum breadth of nearly one-third of a mile, the mean breadth being one-fifth of a mile. Its waters cover an area of about 148 acres, and it drains an area 10½ times greater, or nearly 2½ square miles. The maximum depth of 93 feet was observed about 300 yards from the eastern shore. The volume of water contained in the loch is estimated at 228 millions of cubic feet, and the mean depth at 35½ feet. The breadth of the loch at the position of the deepest sounding is sixteen times the depth. The shore development is 2·15 and the insulosity 0·014.

The 25-feet area is continuous, passing to the north of the large island. The 50- and 75-feet areas lie in the eastern part of the loch, though there is one sounding of 50 feet in the extreme west. The 50-feet area has a length of nearly half a mile, and extends to within 40 yards of the eastern shore, while the 75-feet area is a quarter of a mile in length. The areas between the consecutive contour-lines, and the percentages to the total area of the loch, are as follows :—

Feet.	Acres.	Per cent.
0 to 25	67	45·4
25 „ 50	42	28·3
50 „ 75	20	13·8
over 75	19	12·5
	148	100·0

The temperature of the surface water in Loch Garbhaig at 4 p.m. on July 25, 1902, was 54°·9 Fahr., or nearly 4° warmer than that observed in Lochan Fada, which lies at the same elevation; no serial temperatures were taken.

Loch Clair (see Plate IV.).—Loch Clair is situated about 3 miles to the south-west of Kinlochewe, at the head of Loch Maree. The ground to the north and west rises to the heights of Beinn Eighe and Sgurr Dubh, the lower ground being covered by moraines. It was surveyed on July 24, 1902, by Messrs. Clark and Murray, and the elevation of the water-surface above the sea was determined by levelling from bench-mark as being 303·1 feet.

Loch Clair is over 1⅓ miles in length, with a maximum breadth of about 600 yards, the mean breadth being about 300 yards. Its waters cover an area of about 160 acres (a quarter of a square mile), and it drains directly an area of 6⅓ square miles, but since it receives the outflow from Loch Coulin its total drainage area is 20⅓ square miles —an area 83 times greater than that of the loch. The maximum depth is identical with that observed in Loch Garbhaig, viz. 93 feet, and occurs about 150 yards from the eastern shore off Creag na Rianaich. The volume is estimated at 287 millions of cubic feet, and the mean depth at 42 feet. The breadth of the loch at the position of the deepest sounding is sixteen times the depth. The shore development is 2·01, and the insulosity very small (0·001), there being only two small islands in the loch.

The bottom of Loch Clair is fairly regular, the deeper water being found in the wide south-eastern portion, where there is a 50-feet basin about half a mile in length, enclosing a 75-feet basin one-third of a mile in length. The 25-feet area is continuous, passing to the south of the larger island, between which and the southern shore a depth of 46 feet was found. The areas between the consecutive contour-lines, and the percentages to the total area of the loch, are as follows :—

Feet.	Acres.	Per cent.
0 to 25	58	34·9
25 „ 50	38	24·4
50 „ 75	41	25·9
over 75	23	14·8
	160	100·0

It will be observed that the zone between 25 and 50 feet is smaller than the zone between 50 and 75 feet, indicating that the average slope is steeper in the shallower zone.

FIG. 4.—LOCH COULIN, LOOKING NORTH.
(*Photo by T. N. Johnston, M.B., C.M.*)

Temperature Observations.—A series of temperatures taken at 4 p.m. on July 24, 1902, in the deep water gave the following results:—

Surface	57°·0 Fahr.
5 feet	57·7 „
10 „	57·2 „
20 „	57·2 „
30 „	54·0 „
40 „	49·9 „
50 „	48·7 „
85 „	48·0 „

It will be noticed that the temperature of the water between 5 and 20 feet was higher than that at the surface, the highest reading being at 5 feet. Between 20 and 30 feet a fall of 3°·2 is recorded, and between 30 and 40 feet a fall of 4°·1, a total fall of 7°·3 in 20 feet, the extreme range shown by the observations being 9°·7.

Loch Coulin (see Plate IV.).—Loch Coulin is situated 300 yards to the south-east of Loch Clair, into which it drains. Doubtless, in very recent times, they formed one loch, for the ground between them is low and alluvial. To the south-west and south-east rise Beinn Liath Mòr and Carn Breac. Loch Coulin is very much overgrown with weeds, especially in the narrow north-western portion. It was surveyed on July 24, 1902, by Dr. Johnston and Mr. Hewitt, who found the water-surface to be 304·6 feet above sea-level, or 1½ feet above the level of Loch Clair.

Loch Coulin is 1⅓ miles in length, with a maximum breadth of one-third of a mile, the mean breadth being about 250 yards. Its waters cover an area of 113 acres, and it drains an area 78 times greater, or 14 square miles. The maximum depth of 49 feet occurs near the centre of the broader south-eastern portion of the loch. The volume of water is estimated at 90 million cubic feet, and the mean depth at 18¼ feet. The breadth of the loch at the position of the deepest sounding is 31 times the depth. The shore development is 2·45, and the insulosity *nil.*

Loch Coulin is very irregular in outline, and is cut up into three basins, the north-western basin having a maximum depth of 32 feet, and the central basin a maximum of 22 feet. The main basin is confined to the broad south-eastern part of the loch, and the contour-lines approach very close to the eastern shore, off which the slope is steep. There are two isolated soundings less than 25 feet within this area, and deep water is found at the entrance of the river Coulin. The area covered by less than 25 feet of water is over 80 acres, or 72 per cent. of the entire area of the loch.

Temperature Observations.—A series of temperatures was taken in the deep part of the loch at 5 p.m. on July 24, 1902, with the following results:—

Surface	57°·0 Fahr.
5 feet	57°·0 „
10 „	57°·1 „
15 „	57°·0 „
20 „	55°·5 „
30 „	54°·8 „
40 „	53°·0 „

The temperature was found to be constant from the surface to a depth of 15 feet, thence the temperature fell 4° to the bottom in 40 feet.

Loch Tollie (see Plate II.).—Loch Tollie is situated 1¼ miles to the west of the lower end of Loch Maree, and drains into its north-western arm. The ground immediately surrounding the loch is low, though

Meall Airidh Mhic Criadh to the south-west, and Creag Mhòr Thollie to the south-east, rise to over 1100 feet. The loch is roughly elliptical in outline, the major axis having an east and west direction. One of the islands near the northern shore was for some time a stronghold of the McLeods.

Loch Tollie was surveyed on July 29, 1902, by Dr. Johnston and Mr. Hewitt, who determined the elevation of the lake-surface as being 387·0 feet above sea-level; when visited by the Ordnance Survey officers on November 13, 1869, the level was found to be 387·7 feet. The water must at one time have stood at a higher level, for at the east end, where the stream leaves the loch, there are the remains of a dam (now fast disappearing), which held up the water for supplying a mill farther down the burn.

Loch Tollie is under a mile in length, with a maximum breadth of about 800 yards, the mean breadth being about 500 yards. Its waters cover an area of about 169 acres (a quarter of a square mile), and it drains an area eight times greater, or 2 square miles. The maximum depth of 86 feet was observed in the centre of the loch off the mouth of the Allt Loch Laraig. The volume of water is estimated at 244 millions of cubic feet, and the mean depth at 33 feet. The breadth of the loch at the position of the deepest sounding is 27 times the depth. The shore development is small (1·11), and the insulosity 0·002. The deeper water occurs in the western part of the loch, though the 25-feet area sends a narrow tongue into the eastern part. The 75-feet area in the centre of the loch is small, with a narrow tongue extending towards the northern shore. The areas between the consecutive contour-lines, and the percentages to the total area of the loch, are as follows:—

Feet.	Acres.	Per cent.
0 to 25	81	48·0
25 „ 50	43	25·6
50 „ 75	35	20·6
over 75	10	5·8
	169	100·0

Temperature Observations.—The following series of temperatures was taken in the centre of the loch at 6 p.m. on July 29, 1902:—

Surface	55°·5 Fahr.
5 feet	55°·5 „
10 „	55°·3 „
20 „	55°·3 „
30 „	55°·2 „
50 „	55°·1 „
60 „	54°·3 „
70 „	50°·9 „

This series shows that the temperature was practically constant down to 50 feet, the fall being less than ½°, thence a fall of 0·8 between 50 and 60 feet, and then a rapid fall of 3°·4 between 60 and 70 feet.

Loch Kernsary (see Plate II.).—Loch Kernsary is situated to the north-east of Inveran, at the foot of Loch Maree, into which it drains through the little loch Poll Uidhe a' Chrò' and the Inveran river. There was no boat passage into Poll Uidhe a' Chrò', and it was found impossible to carry the boat across. The ground around Loch Kernsary is low, except to the north, where Meall an Leathaid Dharaich rises to over 400 feet. The island near the south-western shore in the main portion of the loch is an artificial crannog, but nothing is known of its history.

Loch Kernsary was surveyed on July 25 and 26, 1902, by Messrs. Parsons and Garrett, who determined the elevation of the water-surface above the sea, by levelling from Loch Maree, as being 68 feet. The keeper stated that the water would rise 2½ feet above, and fall 1 foot below this level, but a drift mark was observed 8·4 feet above the surface of the water.

Loch Kernsary is about 1⅓ miles in length, with a maximum breadth of nearly half a mile, the mean breadth being about 350 yards. Its waters cover an area of about 200 acres, and it drains directly an area of nearly 7¾ square miles, but since it receives the outflow from Loch Ghiuragarstidh its total drainage area is over 8½ square miles,—an area 27½ times greater than that of the loch. The maximum depth of 93 feet was observed about 250 yards from the north-western extremity of the loch. The volume of water is estimated at 333 million cubic feet, and the mean depth at 38 feet. The breadth of the loch at the position of the deepest sounding is ten times the depth. The shore development is 2·51, and the insulosity 0·008.

The floor of Loch Kernsary is rather irregular, there being two 25-feet areas and four 50-feet areas. The main 25-feet area extends throughout the greater part of the loch, while the smaller one lies in the south-western part of the loch. Three of the 50-feet areas are enclosed by the main 25-feet area: the north-western one containing the deepest water in the loch, the central one having a maximum depth of 66 feet, and the south-eastern one a maximum depth of 69 feet, therefore falling just below sea-level; the fourth 50-feet area, based on soundings of 51 and 53 feet, lies in the centre of the south-western part of the loch. The 75-feet area is situated in the north-western part of the loch, and sinks below sea-level, the deepest spot being 25 feet below the level of the sea.

The areas between the consecutive contour-lines, and the percentages to the total area of the loch, are as follows:—

Feet.	Acres.	Per cent.
0 to 25 ...	72	35·8
25 „ 50 ...	69	34·4
50 „ 75 ...	39	19·8
over 75 ...	20	10·0
	200	100·0

Thus 70 per cent. of the lake-floor is covered by less than 50 feet of water.

Temperature Observations.—A series of temperatures was taken in the deep part of the loch at 2.30 p.m., on July 25, 1902, with the following results:—

Surface	57° 0 Fahr.
10 feet	57°·0 „
25 „	56°·8 „
50 „	53°·0 „
80 „	50°·2 „

This series shows an almost constant temperature down to 25 feet, then a rapid fall of 3°·8 between 25 and 50 feet, and a further fall of 2°·8 between 50 and 80 feet.

Loch Ghiuragarstidh (see Plate II.).—Loch Ghiuragarstidh lies about half a mile to the north of Loch Kernsary, into which it drains by the Allt Loch Ghiuragarstidh. The islands are covered by a few feet of peat and soil, and have many fir-trees growing on them. The loch was surveyed on July 28, 1902, by Messrs. Parsons, Hewitt, and Garrett, who determined the elevation of the lake-surface, by levelling from Loch Kernsary, as being 116·7 feet above mean sea-level.

Loch Ghiuragarstidh is about 1200 yards in length, with a maximum breadth of about 370 yards, the mean breadth being about 230 yards. Its waters cover an area of 58 acres, and it drains an area nearly ten times greater, or about 560 acres. The volume of water is estimated at 23 million cubic feet, and the mean depth at 9 feet. The breadth of the loch at the position of the deepest sounding is 27 times the depth. The shore development is 1·63 and the insulosity 0·028. The bottom is very irregular in the southern half of the loch, large boulders and reefs rising above the surface of the water in many places. In the northern half the lake-floor is more regular, and it is only in this part that the depth exceeds 10 feet, the maximum depth of 37 feet having been observed in the centre of the loch near the northern end. The area of the lake-floor covered by less than 25 feet of water is about 56 acres or 96 per cent. of the total area.

Temperature Observations.—Temperatures taken at 5 p.m. on July 28, 1902, in the deep part of the loch gave the following results:—

Surface	57°·5 Fahr.
5 feet	57°·5 „
7 „	57°·5 „
15 „	57°·1 „
25 „	56°·0 „

Loch a' Bhaid-Luachraich (see Plate V.).—Loch a' Bhaid-Luachraich (or Goose Loch) lies about a mile to the east of Loch Ewe, into which it drains at Aultbea by the Allt Bheithe. It is surrounded by low rounded hills, steep only towards the south-east, covered with peat or morainic material. It is extremely irregular in outline, and in fact may almost be looked upon as two lochs with a connecting arm. The south-western part is shallow, the maximum depth observed in it being 43 feet, while the north-eastern part is much deeper, having a maximum depth of 143 feet; the maximum depth observed in the connecting arm was 15 feet. The lower part where the stream leaves the loch is thickly overgrown with reeds and rushes, and weeds are abundant in the two bays at the head of the loch. It was surveyed on July 29 and 30, 1902, by Messrs. Parsons and Garrett, and the elevation was determined by levelling from bench-mark, as being 309·6 feet above the sea; when levelled by the officers of the Ordnance Survey on August 3, 1870, the elevation was found to be 310·5 feet above sea-level.

From the table at the end of this paper it will be seen that Loch a' Bhaid-Luachraich is over 1½ miles in length, and over a mile in maximum breadth, with a mean breadth of one-third of a mile. It covers an area of half a square mile, and it drains directly an area of 3¼ square miles, but since it receives the outflow from Loch Mhic' Ille Riabhaich its total drainage area is nearly 4 square miles,—an area eight times greater than that of the loch. The volume of water is estimated at 486 million cubic feet, and the mean depth at 34 feet. The bottom in the south-western part of the loch is rather irregular, while the north-eastern part forms a simple deep basin, the maximum depth of 143 feet having been observed near the centre at the widest part of this portion. Section A–B is taken across this wide portion at the position of the deepest sounding. The areas between the consecutive contour-lines, and the percentages to the total area, are as follows :—

Feet.		Acres.		Per cent.
0 to 25	... ...	184	...	56·2
25 „ 50	... ...	84	...	25·5
50 „ 75	... ...	17	...	5·3
75 „ 100	... ...	17	...	5·0
over 100	... ...	26	...	8·0
		328		100·0

These figures indicate that the average slope is gentle in the shallower water, and much steeper in depths exceeding 50 feet, but it will be observed from the map that the contour-lines approach very close to the shores in certain places, indicating a steep slope in these positions.

Temperature Observations.—The surface temperature at 11.45 a.m. on July 29, 1902, was 56°·1, and at 4 p.m. on July 30, when the following series was taken, it was more than half a degree lower :—

Surface	55°·4 Fahr.
10 feet	55°·4 ,,
20 ,,	55°·4 ,,
30 ,,	55°·4 ,,
50 ,,	53°·6 ,,
75 ,,	49°·8 ,,
85 ,,	48°·4 ,,
120 ,,	47°·2 ,,

This series shows a constant temperature from the surface down to 30 feet, then a slight fall of 1°·8 between 30 and 50 feet, followed by a rapid fall of 5°·2 between 50 and 85 feet, thence to the bottom a slight fall of 1°·2, the total range of temperature from surface to bottom being 8°·2.

Loch Mhic' Ille Riabhaich (see Plate V.).—Loch Mhic' Ille Riabhaich is a small irregular shallow loch lying to the south-east of Loch a' Bhaid-Luachraich, into which it flows by the Allt na Criche, surrounded by low rounded hills; on one of the islands is a fortress, but nothing seems to be known of its history. It was surveyed on July 31, 1902, by Mr. Parsons, but its elevation above the sea could not be determined; from the contour-lines on the Ordnance Survey maps it is apparently rather less than 600 feet above the sea. It is half a mile in length from north to south, and rather less in maximum breadth from south-east to north-west. It covers an area of about 36 acres, and drains an area of nearly three-quarters of a square mile. Two soundings of 12 feet were taken near the north end at the outflow, and a sounding of 10 feet off the eastern shore of the larger island; with these exceptions the lake-floor is covered by less than 10 feet of water. The volume is estimated at 8 million cubic feet, and the mean depth at 5⅓ feet.

The temperature of the surface water at 12.30 p.m. on July 31, 1902, was 57°·0 Fahr., identical with the air temperature at the same time.

Loch nan Dailthean (or na Daline), lying to the south-west of Loch Mhic' Ille Riabhaich, and flowing into Loch Thuirnaig (an inlet of Loch Ewe), was visited by the Lake Survey, but not sounded. It is said to be so shallow that cows may walk over the whole of it, except a small hole near Thuirnaig House, in which the depth is 4 feet.

Loch an t-Slagain (see Plate V.).—Loch an t-Slagain lies to the east of Slaggan bay, at the entrance to Loch Ewe, into which it flows by the Allt an t-Slagain. It is surrounded by low hills, and receives the outflow from several small lochs lying to the east and south. It was surveyed on August 11, 1902, by Messrs. Parsons and Garrett, who determined the elevation above the sea by levelling to be 103·5 feet; when visited by the officers of the Ordnance Survey on May 5, 1875, its elevation was 102·6 feet above sea-level. The height of the highest drift mark observed was 2·3 feet above the surface of the water on August 11, 1902, so that the range of level is probably between 3 and 4 feet. The loch trends in a north-west and south-east direction, and is two-thirds of a mile in length by one-third of a mile in maximum breadth. Its waters cover an area of about 77 acres, and it drains an area 17 times greater, or over 2 square miles. The maximum depth of 55 feet was observed comparatively very near the south-eastern shore. The volume of water is estimated at 55 million cubic feet, and the mean depth at 16½ feet.

Loch an t-Slagain is of simple conformation, the 10-feet area being continuous from end to end, but the deeper water is cut into two portions by the shallower water around the central islands. To the north-west of the islands two soundings of 25 feet were recorded, while the deepest part of the loch lies to the south-east of the islands. The areas between the consecutive contour-lines, and the percentages to the total area, are as follows:—

Feet.	Acres.	Per cent.
0 to 10	27	35·3
10 „ 25	39	50·6
25 „ 50	8	10·6
over 50	3	3·5
	77	100·0

Thus 86 per cent. of the lake-floor is covered by less than 25 feet of water, and the major portion is covered by water between 10 and 25 feet in depth.

Loch Sguod (see Plate V.).—Loch Sguod lies less than half a mile from the western shore of Loch Ewe (opposite the Isle of Ewe), into which it flows by the Uidh Chrò. It drains the higher ground to the west and south-west by several streams flowing through the low peat bogs which surround the loch on all sides. It was surveyed on August 15, 1902, by Messrs. Parsons and Garrett, but its elevation above the sea could not be determined; the water may rise 2 feet above its level on the date mentioned. Loch Sguod is nearly three-quarters of a mile in length, with a maximum breadth of nearly half a mile, the mean breadth being a quarter of a mile. Its waters cover an area of about 107 acres, and it drains an area 26 times greater, or 4½ square miles. The maximum depth of 14 feet was recorded towards the eastern shore. The volume of water is estimated at 32 million cubic feet, and the mean depth at 7 feet, or half the maximum depth. The loch is quite simple in conformation, but the deeper water is confined to the central and north-eastern parts of the loch, approaching very close to the eastern shore, off which the slope is steep. The area of the lake-floor covered by less than 10 feet of water is about 78 acres, or 73 per cent. of the total area. The temperature of the surface water at 9 a.m. on August 15, 1902, was 57°·2 Fahr.

Loch an Drainc (see Plate V.).—Loch an Drainc (or an Druing) lies to the north-west of Loch Sguod, and flows through Loch nan Eun (which was not sounded) and the Abhuinn Leumnach into The Minch, about 2½ miles to the west of the entrance to Loch Ewe. The ground around the loch is mostly covered with peat, and to the east are low but steep knolls 200 to 300 feet in height, dotted over with small and beautiful lochs, while to the west and south there is a fairly steep ascent to Maol Breac, An Cuaidh, and Bac an Lethchoin (over 900 feet), the sides of which are well-wooded. It was surveyed on August 16, 1902, by Messrs. Parsons and Garrett, but the elevation above the sea could not be determined; the water may rise 2 to 3 feet above its level on this date. Loch an Drainc trends north-north-west and south-south-east, and is nearly three-quarters of a mile in length, with a maximum breadth of over one-third of a mile, the mean breadth being nearly a quarter of a mile. Its waters cover an area of about 96 acres, and it drains an area 22 times greater, or nearly 3¼ square miles. The maximum depth of 55 feet is approximately centrally placed, but nearer the western than the eastern shore. The volume of water is estimated at 108 million cubic feet, and the mean depth at 26 feet, or nearly half the maximum depth. The loch forms a simple basin, and, considering its area, is comparatively deep, the 25-feet area being over half a mile, and the 50-feet area one-fifth of a mile, in length. The areas between the consecutive contour-lines, and the percentages to the total area, are as follows :—

Feet.	Acres.	Per cent.
0 to 25	47	48·9
25 „ 50	45	47·2
over 50	4	3·9
	96	100·0

Temperatures taken at 3 p.m. on August 16, 1902, gave 59°·0 at the surface, and 58°·0 at a depth of 40 feet.

The deposits from certain parts of Loch an Drainc, as well as of Loch Sguod, were of a strikingly pink colour, and a sample from a depth of 20 feet in Loch an Drainc was found to be coherent when dry, and when wet plastic and creamy, not unlike cocoa and milk of a pink brown colour. The material is made up of probably 90 per cent. of clayey matter with minute mineral particles less than 0·05 mm. in diameter, the remaining 10 per cent. consisting of mineral particles with a mean diameter of 0·15 mm. Quartz is the principal mineral species, but small grains of pink microcline-felspar are very abundant, and it is apparently to this mineral that the pink colour of the deposit is due; the microcline shows cross-hatching, and is much kaolinized. The washed mineral grains have a decided pink tinge, which is, however, much more pronounced in the fine washings. Besides quartz and felspar, white and brown mica, hornblende, garnet, and magnetite were observed. There is little or no vegetable matter.

SUMMARY TABLE.

Giving Details concerning the Lochs described in this Paper.

Loch.	Height above sea. Feet.	Number of soundings.	Length in miles.	Breadth in miles.		Mean breadth per cent. of length.	Depth.			Ratio of depth to length.		Volume in million cubic feet.	Area in square miles.	Drainage area.	
				Max.	Mean.		Max. Feet.	Mean Feet.	Mean per cent. of max.	Max.	Mean.			Total in square miles.	Ratio to area of loch.
Maree	29·5	1196	13·46	2·16	0·89	6·6	367	125·3	34·1	194	567	38,539	11·03	171·66	15·4
Loch on Eilean Subhainn	57·4	10	0·18	0·06	0·04	22·2	64	29·7	46·4	15	32	6	0·01	0·80	80·0
Lochan Fada	[1005]	227	3·74	0·62	0·38	10·2	248	102·2	42·2	80	193	4091	1·44	9·37	6·5
Garbhaig	[1010]	82	1·18	0·30	0·19	16·1	93	35·4	38·1	67	176	228	0·23	2·41	10·5
Clair	303·1	100	1·38	0·34	0·18	13·0	93	42·1	45·3	78	173	287	0·24	20·39	83·2
Coulin	304·6	120	1·33	0·34	0·14	10·5	49	18·3	37·3	143	384	90	0·18	14·07	78·1
Tollie	387·0	101	0·90	0·44	0·29	32·2	86	33·1	38·4	55	143	244	0·26	2·00	7·7
Kernsary	68·0	148	1·35	0·40	0·23	17·0	93	38·2	41·0	77	187	333	0·31	8·56	27·6
Ghiuragarstidh ...	116·7	68	0·68	0·21	0·13	19·1	37	9·1	24·5	97	396	23	0·09	0·87	9·7
Bhaid-Luachraich ...	309·6	217	1·57	1·10	0·33	20·8	143	34·0	23·8	58	244	486	0·51	3·91	7·7
Mhic' Ille Riabhaich ...	[less than 600]	34	0·49	0·46	0·11	22·4	12	5·3	44·6	216	483	8	0·06	0·67	11·2
An t-Slagain	103·5	64	0·65	0·30	0·18	27·7	55	16·4	29·9	62	209	55	0·12	2·04	17·0
Sguod	—	48	0·72	0·44	0·24	33·3	14	6·9	49·4	271	550	32	0·17	4·47	26·3
An Drainc	—	58	0·72	0·36	0·21	29·2	55	25·9	47·0	69	147	108	0·15	3·48	22·9
		2473										44,530	14·80	185·51 *	12·5

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* The drainage area of Loch Maree includes those of Lochan Fada, Lochs Garbhaig, Clair, Coulin, Tollie, Kernsary, and Ghiuragarstidh; and that of Loch a' Bhaid-Luachraich includes that of Loch Mhic' Ille Riabhaich.

The particulars regarding the lochs dealt with in this paper are collected together in the table on p. 568 for convenience of reference and comparison.

From this table it will be seen that in the fourteen lochs under consideration, which cover an area of nearly 15 square miles, nearly 2500 soundings were taken, or an average of 167 soundings per square mile of surface. The aggregate volume of water contained in the lochs is estimated at 44,500 millions of cubic feet, and the area draining into them is 185½ square miles, or 12¼ times the area of the lochs.

NOTES ON THE GEOLOGY OF THE LOCH MAREE DISTRICT.*

(*With Geological Map.*)

By B. N. Peach, LL.D., F.R.S., and J. Horne, LL.D., F.R.S.

The Loch Maree district presents features of special geological importance relating to the subdivisions of the Archæan rocks, to the topography of the old pre-Torridonian land surface, and to the series of terrestrial movements which affected the north-west Highlands in post-Cambrian time. Throughout the mountainous region, stretching north to Dundonnell forest and south to Achnashellach and Glen Shieldaig, excellent sections are to be found showing the geological structure of that region.

The Archæan rocks (𝔄 on map), lying to the west of the great post-Cambrian displacements, occur mainly in the north-west of the area, where they form a broad tract of mountainous ground between Loch na Sheallag and Loch Maree, and westwards by Torrisdale to Gairloch. There is also an important development of them on both sides of Loch Torridon above Loch Shieldaig, and they likewise appear as inliers, surrounded by Torridon Sandstone, as for instance on the southern slope of Beinn Dearg north of Liathach. Within the territory affected by the post-Cambrian movements there are masses of displaced gneiss, of which the most important lies immediately to the north of Kinlochewe; others appear further north on Mullach Coire Mhic Fhearchair, and far to the south on Glas Bheinn, on Torr na h-Iolaire and at Coulags in Glen Carron. Over much of the region they form lofty ground and give rise to prominent peaks, as, for example, Ben Lair (2817 feet), Beinn a' Chaisgein Mor (2802 feet), and Ben Airidh Charr (2593 feet), all north of Loch Maree.

Throughout this area there is a remarkable development of those types of Archæan rocks that have affinities with plutonic igneous products, consisting mainly of massive and foliated, pyroxenic, hornblendic, and micaceous gneisses. Along the northern margin of this district, between Loch na Sheallag and Gruinard Bay, the original characters of the rocks that enter into the fundamental complex are well displayed. The various stages in the separation of the ferro-magnesian from the quartzo-felspathic constituents, and the gradual development of mineral banding in the massive gneisses, are there clearly shown. In that area, also, the intrusive character of the basic dykes traversing the gneiss in a west-north-west direction is proved beyond all doubt. Passing southwards to the tract lying south of Poolewe, both the gneisses and the intrusive dykes have been thrown into an anticlinal fold, which is represented on the geological survey map (Sheet 91). Here we find that, under the influence of mechanical stresses, there has been differential movement of the rock constituents, and linear foliation has been developed in the basic dykes—the foliation being parallel with the pitch of the folds. Further south in the Torridon district biotite gneisses prevail, which are traversed by bands of hornblende schist representing the original basic dykes.

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* Published by permission of the Director of the Geological Survey. Map, p. 616.

Of special interest is the development of crystalline schists, that have affinities with rocks of sedimentary origin, north of Loch Maree and near Gairloch. The prominent members of this series are quartz-schists, mica-schists, graphitic schists, limestones, and dolomites, with tremolite, garnet, and epidote, which are there associated with a massive intrusive sheet of hornblende-schist. Lithologically some of these crystalline schists closely resemble the altered sediments in the Eastern Highlands. The quartz-schists, mica-schists, and limestones, are well exposed in various folds between Letterewe and Glen Tulacha, west of Lochan Fada, pierced by the great sill of hornblende-schist forming Beinn Lair and Beinn Airidh Charr (B^{G} on map). The original relations of these altered sediments to the gneisses that have affinities with plutonic igneous rocks have been obscured by subsequent earth stresses. But along their outer margin they are bounded by gneiss apparently underlying them, and they are visibly overlain by gneiss with basic dykes, the whole series being affected by a common system of folds.

One of the most remarkable geological features of the Loch Maree district is the evidence relating to the topography of the primeval land-surface on which the Torridonian sediments were laid down. Between the head of Loch Maree and Strath na Sheallag, where the overlying red sandstone has been partly removed by denudation, it is possible to trace the direction of the old valleys and the orientation of the ancient peaks. On the eastern slope of Ben Slioch, near Glen Fhasaigh, the observer may climb one of these hills, which rises to a height of about 2000 feet in the midst of the Torridon Sandstone, and trace the alternation of breccia and sandstone filling the ancient valley. Similar evidence is obtained further north in the mountainous region near the head of Glen na Muic. Where these deeply-eroded valleys are preserved, breccias of local origin frequently appear at the base of the Torridon Sandstone. In the Loch Maree district this formation has been subdivided into three groups: a lower, consisting of epidotic grits, dark and grey shales, with calcareous bands and red sandstones; a middle, composed of a great thickness of false-bedded grits and sandstones with scattered pebbles; an upper, comprising chocolate-coloured sandstones, micaceous flags, with dark shales and calcareous bands. The members of the lower group are well displayed in the district near Talladale and Slattadale, on the south-west shore of Loch Maree; those of the middle group are typically developed in the mountains round Loch Torridon, from which district this system takes its name, while the upper group appears in the islands north of Gruinard. Throughout this region this formation (*t* on map) reaches a vast thickness, for on the shores of Loch Torridon it rises on Liathach from the sea-level to a height of over 3000 feet. In the mountains between Slioch and An Teallach these sandstones have a gentle dip towards the south-east; in the Torridon district they are nearly horizontal, while further south they form a low arch.

As indicated in our previous notes on the geology of the Assynt district, the Torridon Sandstone is separated from the overlying quartzites by an unconformability, which in some parts of the Loch Maree area is not so prominent as in Assynt. On An Teallach in the Dundonnell Forest and southwards towards Mullach Coire Mhic Fhearchair, the Cambrian quartzites are inclined at a higher angle to the south-east than the Torridon Sandstone. In the area lying to the west of the post-Cambrian displacements we find at various localities the normal

Cambrian sequence in ascending order—1, the basal quartzites (a^1 on map); 2, the pipe-rock (a^2); 3, the Fucoid beds (a^3). This sequence is displayed in the Dundonnell Forest, on the western slope of Ben a' Vuinie near Kinlochewe, on the west declivity of Meal a' Ghuibhais south of Loch Maree, and on Beinn Eighe. Within these limits the Fucoid beds have yielded at several localities well-preserved trilobites and other organic remains of Lower Cambrian age. The Cambrian limestone rarely appears in the undisturbed area; in the displaced masses west of Glas Bheinn towards the head of Loch Kishorn it is largely represented.

The evidence bearing on the post-Cambrian movements obtained in the Loch Maree district is of special interest. On referring to the map, it will be seen that the belt affected by these movements runs southwards from Dundonnell by Kinlochewe, Beinn Eighe, and the Coulin Forest to Glen Carron and Loch Kishorn. Throughout this area the geological structure is extremely complicated, but certain sections may be referred to as illustrating the continual variation in the relations of the rocks. The simplest type is met with in the Dundonnell Forest, where on the west slope of Creag Rainich there are two powerful thrusts running parallel with each other for some distance in a north-north-east and south-south-west direction. West of these lines of displacement the Cambrian sequence is undisturbed from the basal quartzites to the Fucoid beds. On the horizon of the latter the first powerful thrust is met with, which brings forward a slice of Torridon Sandstone with a core of Archæan gneiss. Not far to the east the second thrust supervenes, which ushers in the crystalline schists overlying the Moine thrust-plane. A repetition of this structure in a more complicated form is found in the tract between Glen Fhasaigh and the heights of Kinlochewe, where the mass of displaced gneiss with its intrusive dykes is admirably displayed between the Moine thrust to the east and the outcrop of the Kishorn and Kinlochewe thrust-plane west of Ben a' Vuinie.

In the region stretching south from the head of Loch Maree by Beinn Eighe and the Coulin and Achnashellach Forests to Loch Kishorn the structure is more complicated. For to the west of the two great lines of displacement just referred to, which have been traced south to Loch Kishorn and Glen Carron, the Torridon Sandstone and Cambrian strata have been repeated by a series of inverted folds and minor thrusts. Hence we find strips of Cambrian quartzite alternating with Torridon Sandstone, the strata having a general dip towards the south-east as if they formed part of a normal ascending sequence. The clear sections, however, on Beinn Eighe, on Sgurr Dubb, Beinn Liath Mhor, Sgurr Ruadh, and other peaks, show the overfolding and reversed faults which are the prominent features of the structure of that region. Still further south, towards the head of Loch Kishorn, and west of the slice of Archæan gneiss overlying the Kishorn thrust-plane, there is a constant repetition of the Fucoid beds and Cambrian limestone by inverted folds and reversed faults.

In the Loch Maree district, as in Assynt, there is evidence of the development of new structures resulting from the post-Cambrian movements. The deformation of the Torridon Sandstone, west of the Moine thrust, is well displayed in the stream south of the Kinlochewe Hotel, where the grits have been made schistose, and where the felspars have been partially broken down and reconstructed. Near the outcrop of the Kishorn thrust, west of Glen Carron, the Lewisian gneiss is sheared and rolled out, passing into flaser gneiss and schist with a platy or fluxion structure.

East of the Moine thrust, which runs south from Dundonnell by Loch an Nid, the heights of Kinlochewe, and Loch Coulin to Glen Carron, the area represented on the map is occupied by crystalline schists of a remarkably uniform type. They consist mainly of flaggy granulitic quartzose schists and mica-schists, with prominent belts of garnetiferous muscovite-biotite schists. The latter are well developed on Fionn Bheinn, north of Achnasheen, and on Sgurr Mor Fannich, where they form conspicuous crags. Near the Moine thrust, and, indeed, for some miles to the east of the plane of that thrust, the Eastern or Moine schists have a persistent dip to the south-east. In the Fannich mountains they are overfolded on a stupendous scale, and similar evidence is obtained in the group of mountains north of Achnasheen.

Reference must now be made to the faults that affected the area after the post-Cambrian thrusts. Of these by far the most important is the great line of displacement that crosses the region in a north-west and south-east direction, coinciding with the long axis of Loch Maree, which may be termed the Loch Maree fault. It has been traced in a north-west direction along the river Ewe, by the south margin of Loch Ewe, towards Loch an Drainc, where the Torridon Sandstone on the north-east side is faulted down against the Lewisian gneiss at Poolewe. At Kinlochewe this dislocation has been traced up Glen Dochartie and onwards in the direction of Ledgown. Indeed, the probable continuation of this fault has been recently found far to the south-east—in the basin of the Conon. Where the line of fault is not obscured by drift, it gives rise to a prominent feature on the surface of the ground. This powerful fault shifts the outcrops of the Moine and Kishorn thrust-planes, and likewise of the overfolded strata associated with these thrusts. It further shifts the outcrop of the normal fault in Glen Fhasaigh, which runs in a north-east direction between the head of Loch Maree and Lochan Fada (see map). The continuation of the Fhasaigh fault is to be found in Glen Grudie, on the south side of Loch Maree, so that its outcrop is shifted at least for a distance of 2 miles by the Loch Maree dislocation.

In the north-west part of the area, in Isle Ewe, and in the promontory between Loch Ewe and Gruinard Bay, there is a strip of Triassic Sandstone (*f* on map), thrown down by two powerful faults.

Throughout the Loch Maree district, and especially in the mountainous region embracing the Torridon Sandstone and Cambrian quartzite, there is evidence of intense glaciation. During the climax of the glacial period, even the highest mountains in the Loch Maree district were overridden by the ice. Some of the evidence pointing to this conclusion may here be referred to. Along the top of Ben Slioch (3217 feet), which, as already indicated, is composed of Torridon Sandstone, blocks of thrust Archæan gneiss, Cambrian quartzite, and Moine schists are met with, all of which have been derived from the east. Similar evidence is obtained on Meall Ghuibhais (2882 feet), on the south side of Loch Maree. Again, in the Coulin Forest, on the lofty ridge running south from Sgurr Dubh (2566 feet) to Beinn Liath Mhor (3034 feet), striæ have been recorded pointing in a westerly direction at elevations ranging from 1750 to 2000 feet. Blocks of crystalline schist derived from the area east of the Moine thrust, and occasional fragments of thrust Archæan gneiss, appear on this ridge. Further south on Sgurr Ruadh, ice-markings pointing a few degrees to the north of west occur at an elevation of 2500 feet. The top of Ruadh Stac (2919 feet), on the east side of Glen Kishorn, is finely glaciated, the striæ pointing W. 25° N. The summit of Meall a' Chinn Dearg (3095 feet), composed chiefly of Torridon Sandstones and grits, is strewn with transported blocks of Cambrian quartzite. Similar evidence might be adduced regarding that part of the Applecross area which is shown in the south-west corner of the map. For there, on Beinn Bhan (2936 feet), striæ have been recorded underneath the 2750 feet contour-line trending W. 13° to 20° N. Blocks of the Eastern or Moine schists appear at that level, and are fairly plentiful below 2500 feet. From these facts the inference seems obvious that during the maximum glaciation, the western part of Ross-shire must have been completely overridden by ice moving in a westerly direction towards the sea.

The westerly flow of the ice is confirmed by the transport of the boulders in the drift deposits, which consist mainly of moraines in the area lying to the west of the Moine schists, and these contain numerous blocks of quartzose schist and mica-schist derived from the east.

After the disappearance of the great ice-sheet there ensued a period of confluent valley glaciers. The direction of the ice-flow during this later glaciation is represented on the map by feathered arrows. On referring to the map, it will be seen that the prominent mountain groups north and south of Loch Maree formed independent centres of glaciation. In many of the valleys there is a splendid development of both lateral and terminal moraines. The closing phases of the glaciation of the region is indicated by the moraines encircling some of the high corries, and by similar deposits resting on the 50-feet beach at the head of Loch Torridon, where they have been recorded by our colleague, Mr. Hinxman.

A glance at the map will show that Loch Maree is by far the largest rock-basin in that district; but as it lies along the line of a powerful fault, which has given rise to a prominent feature in the topography of the region, we prefer not to discuss its features in connection with the theory of the glacial origin of lake-basins.

Lochan Fada is a simple rock-basin resting partly on Torridon Sandstone and partly on Lewisian gneiss. Along the greater part of its course it coincides with an old pre-Torridonian valley, trending in a west-north-west direction. At its eastern end it is bounded by the continuation of the Glen Fhasaigh fault, which brings down the Cambrian quartzite, Fucoid beds, Serpulite grit, limestone, and overlying Archæan gneiss above the Glen Logan or Kishorn thrust plane. The sudden deepening of the loch at its lower end is evidently related to this fault, because harder and more durable strata on the east side of this fault have been brought against the softer Torridon Sandstone to the west. It is important to note that the downthrow side of this fault is towards the east; in other words, the eastern floor of Lochan Fada is not faulted down to the west. It is interesting to note that the deepest part of the basin, and the deepest sounding (248 feet), lie between Slioch and Ben Tarsuinn, where the erosion of the ice during the maximum glaciation would probably be greatest.

Loch Garbhaig, which is situated to the north of Ben Slioch, is a small lake over a mile in length, and evidently a rock basin from the appearance of Lewisian gneiss at its exit, where it is drained by the Amhainn na Fuirneis. The soundings prove the existence of two basins separated by a ridge, the eastern one reaching a depth of 93 feet, and the western 50 feet close to its outlet. This lake lies mainly along the junction of the Archæan rocks and Torridon Sandstone, the older rocks forming the greater part of the north shore, and the red sandstone the larger part of the south margin. A tongue of Torridon breccia occupies a hollow in the Archæan rocks on the north shore, where it rests on a mass of hornblende-schist. This breccia appears in an island in the loch, which forms part of the ridge separating the two basins. The loch may therefore be regarded as a rock basin eroded by ice, mainly out of Torridon Sandstone along its line of junction with the Archæan floor.

Loch Kernsary is very irregular in shape, and has four basins below the 50-feet level, the deepest sounding—93 feet—being found near its north-west extremity. The Archæan gneiss forms part of its north-east shore, while the Torridonian rocks floor the remaining portions, save near the west limit of the north shore, where a boss of Lewisian gneiss projects through the Torridon Sandstone. As the Torridon sandstones and conglomerates dip at angles varying from 20° to 35° to the north-west, we may infer that those sediments are resting on a very uneven floor of gneiss. The bed of the lake, therefore, may here correspond with the pre-Torridonian surface, the softer Torridon Sandstone being more easily removed than the more durable gneiss. Striæ pointing in a north-west direction are found round the lake, the trend of which is slightly oblique to the long axis of the loch, but almost parallel to that of the 50-feet basins. The latter in turn have their longer axes somewhat oblique to the strike of the Torridonian strata.

Loch Ghiuragarstidh is a shallow loch lying along the strike of the Torridon Sandstone, with an exposure of Lewisian gneiss near its outlet, its greatest depth being 37 feet. A long ridge of sand and gravel, probably a moraine, occurs near its mouth, so that this lake may lie partly in drift and partly in rock.

Loch Tollie is a true rock-basin of very irregular shape, surrounded by Lewisian gneiss, the deepest sounding being 86 feet. This basin belongs to the shallow plateau type so common in the Archæan area in the west of Sutherland. Its irregularity is due to the folding and intense shearing of the component members of the Lewisian gneiss in that region. Glacial striæ are met with at several localities round the loch, varying in direction from W. 10° N. to W. 41° N. The dominant strike of the foliation of the gneiss is west-north-west and east-south-east. The long axes of the bays of the loch are more in accordance with the direction of the ice-flow than with the strike of the foliation.

Loch Clair lies partly in moraine drift and partly in thrust Torridonian strata. Drift occurs at the outlet and along its western margin, and all the islands are composed of moraines.

Loch Coulin is separated from Loch Clair by an alluvial fan brought down by Allt na Luib. The river Coulin has silted up the greater part of the upper end of the lake, and its limits have been still further restricted by detritus borne downwards by the streams on the north.

THE EVOLUTION OF CLIMATES.

In a paper under this title, reprinted, with additions, from the *American Geologist*, August to October, 1899, Mr. Marsden Manson propounds yet another theory to account for the warm and cold periods of geologic time, as recorded by evidence of past distributions of flora and fauna and of glacial action. The main point of the theory is a return to the now universally abandoned hypothesis of the control of climate, since the advent of living organisms, by heat conducted from the interior of the Earth. "*Earth-heat* controlled surface temperatures during its prevalence, and by the laws of cooling solids was uniformly distributed at sea-level; it was held near the planetary surface by the enshrouding media, by which it was trapped, and through which it escaped slowly, not by direct radiation, but by the performance of work, namely the evaporation of water, and by convective currents which carried warm air to the upper regions of the atmosphere, from which regions only could free radiation of heat into space take place. *Solar* energy did not directly affect surface temperatures during the existence of earth-heat as a sensible factor, by reason of the intervention of a dense cloud-sphere incident to the universally warm oceans whose temperature is attested by early fossil life; but during this period solar energy acted as a conservator of planetary heat by warming the upper regions of the atmosphere and clouds." . . . "Land areas reached glacial temperatures earlier than ocean areas, by reason of the low specific heat of earth and rocks, their more intense rate of radiation, through the cooling action of rain and snow, and by reason of greater elevation." . . . "They were subjected to maximum glaciation along lines of maximum precipitation, and may have escaped all but light local glaciation in regions of maximum cloud formation and precipitation." . . . "Upon the cooling of the oceans, the effective remnant of earth-heat was exhausted and cloud formation reached a minimum, permitting solar energy to reach the surface and to assume domination and control of its temperatures." " . . . The climates of such control became zonal by reason of direct exposure to a zonally distributed source, and these climates gradually rose in temperature by reason of the trapping of heat rays emitted by the warming planetary surface; such rise is yet in progress, as recorded by retreating glaciers and advancing plant and animal life." All evidence of glacial action in pre-Tertiary times is dismissed as local and due to elevation alone.

We confess that Mr. Marsden's paper leaves us altogether unconvinced. It is difficult to regard the view that the climate of the whole globe was of uniform slowly falling temperature up to nearly the end of the Quaternary glacial period as established, but Mr. Marsden merely quotes some authorities in support, and deals with no difficulties. If we accept it, it does not seem easy to explain the survival of warm-climate animals and plants during a non-zonal glacial period. But the chief obstacles to the establishment of Mr. Marsden's theory lie in the domain of atmospheric physics. Assume the rather incredible cloud-covering; then inside we have uniform temperature, and therefore, presumably, no circulation. Nevertheless, the regions of maximum and minimum precipitation are taken to be the same as they appear on modern rainfall maps, which are quoted, and these regions are determined by modern zonal circulation. Again, the uniform temperature inside the cloud-covering, which we may suppose began when water-vapour was first condensed, is said to give place to a difference of temperature due to the land surface cooling faster than the sea. This difference must have gone on increasing, and by Tertiary times have become very considerable, yet it apparently produced no circulation. One would expect something of the nature of winter monsoon conditions, only permanent all the year round: the winds would everywhere blow seaward; on the sea there would be ascending air and constant precipitation, as in the equatorial belt of modern times; on the land descending air, no rainfall, and a hole in the essential cloud-cap, as in the modern tropical belt. Lastly, it is admitted that solar radiation is "zonally" effective on the outer, or upper, surface of the cloud-cap. Hence, in the upper atmosphere there would be a planetary circulation undisturbed by any land and sea influences, and strongly developed just in proportion as the cloud-cap was effective in shutting off solar radiation from the lower atmosphere. But we are to suppose that this circulation went on without producing any effect on the cloudy surface, or inducing any motion in the levels below.

THE FIFTH ITALIAN GEOGRAPHICAL CONGRESS.*

The Fifth Italian Geographical Congress took place at Naples between April 6 and 11 of the present year, and was attended by 220 members, mostly from various parts of Italy, but including also a few from other countries. The arrangements had been carried out under the active superintendence of Prof. Porena of Naples, and the programme included excursions to Pompeii, Capri, and other places round the Bay of Naples, while two exhibitions—one cartographical, the other Vesuvian—had also been organized. Important maps, including two embodying new topographical surveys of Vesuvius, were presented by the Military Geographical Institute.

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* Communicated by Prof. Guido Cora, who represented the Society at the Congress.

After a preliminary meeting, at which Prof. Porena was unanimously elected president, the inaugural meeting took place on the afternoon of April 6, the opening address being delivered by Prof. Orlando, Minister of Public Instruction, in the name of the king. Prof. Porena's address, which followed, gave a brief but clear summary of the progress of geography in Italy down to the present time, dealing especially with the important part played by Naples in the history of cartography from the eleventh century onwards, and in the modern colonial undertakings of Italy. Prof. Cora subsequently conveyed to the Congress the greetings of the Royal Geographical Society, and spoke of the successful issue of the National Antarctic Expedition.

The Congress was divided into four sections, viz. (*a*) Scientific (mathematical geography, cartography, physical geography, and exploration); (*b*) economic and commercial (emigration, colonization, etc.); (*c*) educational; (*d*) historical (history of geography and cartography). The total number of papers and communications was 107, while the votes passed numbered 51. It is possible here to refer only to some of the more important questions dealt with.

In the scientific section, physical geography engaged the largest share of attention, but there were also some important communications on ethnography, cartography, bibliography, and on the better transcription and orthography of geographical names. Recommendations were addressed to the Military Geographical Institute of Florence, (1) for the extension to the whole of Italy of the surveys on the scale of 1 : 25,000; (2) for the preparation of a chorographical map of Italy on the scale 1 : 200,000, with an indication in colour of woods and copses; and (3) for the completion of the topographical survey of Eritrea. The paper by Prof. F. Musoni on the scientific investigation of caves [*] and another by Prof. F. Porro on the present state of research in regard to Italian glaciers,[†] attracted much interest and were followed by instructive discussions. A preliminary report, full of important notes, was presented by Prof. L. Palazzo on the limnological stations established by the Italian Geographical Society on the Lake of Bolsena, to which reference was made in the October number of the *Journal* (p. 476). A paper on the limnology and depressed areas of Italy was also presented by Prof. O. Marinelli. Amongst other noteworthy papers on physical geography, we may mention the following: "On the Systematical Study of Landslips in Italy," by R. Almagià; "On Earthquakes and Underground Air," by Prof. G. Uzielli; "On the Study of Thalassology in Italy," by Prof. L. Marini; "On Potamological Research," by Signor De Magistris.

A proposal having been made by Signor A. Baldacci to form an international committee for the preparation of an ethnographical map of the Balkan peninsula, Prof. Cora read a paper on the ethnography of Croatia and Servia, based on his journey in those countries in 1902, showing that the Bulgarians and Albanians, although they have mostly adopted the habit and language of the country, are still very numerous in southern Servia, a fact not brought out by the official publications, which quote only the language now spoken.

In the economic-commercial section many of the communications, *e.g.* those of Profs. V. Grossi, A. Blessich, and Forrano, had to do with the countries of South

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[*] As a result of the vote urging the Italian Alpine Club to promote the formation of speleological clubs or commissions, a "Circolo Speleologico" has been formed in Rome, with Prof. Guido Cora as president and Dr. E. Abbate as secretary.

[†] The permanent Committee of the Italian Geographical Congresses (Rome), at its meeting of June last, decided, in accord with the Italian Alpine Club, that a special committee should be appointed for the study of Italian glaciers.

America, to which the commerce and emigration of Italy is so largely directed, viz. Brazil and Argentina. Others dealt with the principles and methods of emigration (Prof. B. Frescura); the commerce, agriculture, and railways of Eritrea (G. Buonomo, G. B. Penne, Prof. A. Roncali); and with forestry in the Balkan peninsula (A. Baldacci). A communication was made by Signor L. Cufino on the road from Assab to Æthiopia through the valley of Golima (based on a paper by Prof. Cora); while Signor M. D'Amelio gave some account of recent explorations in the interior of the Dankali country by the Italian officers, Oglietti and Pántano, and the Resident of Assab, which will throw new light on the geography of this little-known country; Prof. Cora adding some notes on the first Italian explorers in this region.

In the section for education many important discussions took place, mostly bearing on the improvement and extension of geographical teaching in the Italian universities, in naval and military institutes, and the like.

It is impossible to mention all the communications presented to the historical section, many of them of quite a special character. Among the most interesting we may notice those of Prof. Uzielli (combating the views of Gonzales de la Rosa and Vignaud as to the authenticity of Toscanelli's letter, and urging the publication of the contemporaneous Vespucci Codex); of Prof. Bruzzo (on the work performed by L. F. Marsigli); of Prof. Crinò (on a manuscript portolano of the seventeenth century); papers relating to Sicily (by Prof. Crinò, G. D. Vita, and Prof. A. Enrile), and to the "Ager Picentinus" (Prof. L. Foglia). Prof. G. Grasso spoke of the life of Captain Cook; and a paper was also presented on the Italian origin of the nautical compass, attributed by Dr. L. Posteraro to Salomone Ireneo Pacifico (778–846).

Besides the work of the separate sections, three lectures were delivered before the Congress as a whole. The concluding general meeting took place on April 11, Venice being selected as the place of meeting of the next Italian Geographical Congress (1907). It is hoped, however, to hold a special Colonial Geographical Congress in Asmara in September, 1905, with a view to making the colony of Eritrea better known than at present.

REVIEWS.

ASIA.

The Philippines.

'The Gems of the East.' By A. Henry Savage Landor. In 2 vols. 8vo, pp. vi., 328 and 460. *Illustrations and Map.* London: Macmillan. 1904. *Price*, 30*s*.

Mr. Landor's book opens with the sentence, "Follow me, and you will travel quickly." He is speaking of his journey to the Philippine archipelago, the subject of the volumes before us, and his desire to lose no time in getting on to the ground cannot be regarded as other than praiseworthy. But the reader soon finds that this motor-car ideal of travel is not limited to the crossing of the two oceans and the American continent, but is adhered to throughout the journey. The excellent map of the Philippines, given at the beginning of the first volume, is crossed and recrossed in all directions with the red lines which depict the author's route. He tells us that in the 250 days he spent in the archipelago he covered over 16,000 miles.

For the most part Mr. Landor's journeys consisted in going from island to island and touching at their innumerable ports, but he also crossed Cebu, Negros, and Panay, and made some lengthy land journeys in northern Luzon. It was in Mindanao, however, that he was in least frequented paths. Here he saw some fighting, accompanying the American forces on the occasion of the taking of Fort Bacolod, on Lake Magindano, and afterwards continuing his route northward to Iligan bay. He also crossed the island in two other parts—in an easterly direction from Kota Batu (Cottobatto) to Davao along a very little-known trail, and from south to north from the last-mentioned place to Butuan *viâ* the Agusan valley, a journey first made, if we remember right, by Montano in 1880, and later by various travellers. Mr. Landor is no naturalist—he talks, it may be remarked *en passant*, of "trees of the genera *Ficus elastica* and *palaquium*," and of "a specie"—but he appears to have taken considerable interest in the numerous tribes with whom he was brought in contact, and furnishes a number of somewhat elaborate tables of measurements, though such value as these have is lessened by its not being stated whether they are of one, or the mean of many, and if so, how many individuals. Of all the tribes described, the Igorrotes and Tagbuanas—or, as the author prefers to call them, Tagbanouas—are perhaps the most fully dealt with. The former, he thinks, are related to the Ainus, a sufficiently curious affinity, if true; while the Tagbuanas, he considers, "have many Australoid or Papuan characteristics about their features"—a sentence which, if it means anything, can only be interpreted as implying Australian and Papuan to be of the same stock. The ethnologist will find a good deal about a number of by no means well-known tribes, but he will perhaps wish that the details had been recorded with more scientific preciseness. The deciphering of the puzzle of the races and peoples of the Philippines is no easy task, and can only be accomplished with the aid of more accurate data than a rapidly moving traveller can afford, however great his diligence.

From Mr. Landor's pages a tolerably clear idea of the position and work of the Americans can be gathered. He points out that, whatever his faults, the Spaniard had at least the merit of doing everything in the way of public works, and especially roads and bridges, on solid and permanent lines, while his successor does but little in this way, and hopes to civilize the native on a curriculum of literature, history, and the higher mathematics. Drinking-saloons are too numerous, and in other respects America has still a good deal to learn in the art of managing a colony. The author, however, has not especially laid himself out to record the present-day condition of the islands so much as to describe the episodes of his journeys and the peoples with whom he was brought in contact. The volumes also contain a great number of remarks on the reefs, shoals, and cays, and the soundings over them. There are also numerous notes on diseases, though here the reader will occasionally find things which do not occur in the text-books, as, for example, the statement that the Filipinos "are not yet foolish enough to hold mosquitoes responsible for the introduction of malarial fever."

F. H. H. G.

Research in the Malay Archipelago.

Siboga-Expeditie. Uitkomsten op zoologisch, botanisch, oceanographisch en geologisch Gebied verzameld in Nederlandsch Oost-Indië 1899–1900 aan boord H.M.S. *Siboga* . . . uitgegeven door Dr. Max Weber.' [To be completed in 65 monographs.] Leiden: E. J. Brill. 1901—.

The expedition of the Danish man-of-war *Siboga*, which spent about a year (March, 1899, to February, 1900) in the scientific exploration of East Indian waters, adds another to the now numerous researches within limited areas which during the last few years have been gradually filling in the details of the main outlines sketched by the great deep-sea expeditions, like that of the *Challenger*. The reports of the *Siboga* Expedition are to be issued in sixty-five parts, of which we have now before us the narrative of the voyage, the parts describing the ship and its scientific appliances, and the account of the hydrographic results.

The history of the expedition is set forth by Prof. Dr. Max Weber, its scientific director, in an extremely lucid introduction to the "Narrative." There has never been any lack of interest amongst Dutch scientists in the great problems of those regions, which may perhaps be not inadequately summed up as the question of "Wallace's Line," the question of the true boundary between Asia and Australasia. Direct contributions to the hydrographic side of this question were made by the *Challenger* and *Gazelle* expeditions; but it was evident that detailed surveys of the bed of the seas, and of their fauna and flora, must be made, and this need was specially impressed upon the public of Holland in articles by Hubrecht (1889) and Kan (1888 and 1895), and by the constant activity of Mr. Treub, the director of the Botanic Gardens at Buitenzorg. The matter was finally taken up by the *Société pour l'encouragement des explorations aux Colonies néerlandaises*, and in 1898 the Government of the Dutch Indies placed the *Siboga* at the disposal of Dr. Max Weber, who was appointed director of the expedition. The *Siboga* was at that time being completed in the Government dockyard at Amsterdam. She was equipped with appliances and machinery before setting out, and left Amsterdam in December, 1898, under the command of Lieut. G. F. Tydeman, of the Dutch navy. Batavia was reached on February 7, 1899, and on the 11th the *Siboga* left for Surabaja, where guns and ammunition were put ashore, and fitting out for the scientific work of the expedition completed. The expedition itself was divided into three voyages—March to May, 1899; June to October, 1899; and October, 1899, to February, 1900; and the ship returned to ordinary service on March 16, 1900.

Dr. Weber's "Narrative" contains a general account of the work of the expedition, and deals in detail with the results of the soundings, the discussion of zoological and other special questions being reserved until the material collected has been worked up. We may note as of particular interest the soundings in the Strait of Lombok, which showed a ridge between Bala and Lombok with a maximum depth of 312 mètres, and the survey of the southern part of the Strait of Makassar. The work of the expedition in the Banda sea is also of immense value; the clearing-up of its relation to the Ceram sea and Molucca passage, the discovery of the "Siboga ridge," with the disproof of the existence of the supposed "Weber deep," the definition of the lenticular depression west of the Kei islands, and the discovery of deep-water communication between the Banda sea and the Flores and Bali seas, all afford new and precise information about a region of great complexity. The report on the geological investigations, which is in the hands of Dr. A. Wichmann, will doubtless throw much light on the complex disturbances to which the remarkable configuration disclosed is due. Dr. Weber's "Narrative" is full of suggestive observations on matters zoological, botanical, ethnographic, and so on; we only regret the absence of a summary of results, especially of the soundings, which would save the considerable trouble of extraction from the general text.

In the second monograph, Lieut. Tydeman describes the ship and the scientific appliances used. The equipment was provided after consultation with such authorities as Prof. Chun, Prof. Hensen, and Dr. Schott, and seems to have been adequate and satisfactory, although there are no novel features of interest, except in matters of detail.

The third monograph, on hydrographic results, is also by Lieut. Tydeman. The most important contribution in the volume is the two charts in which the soundings of the *Siboga* are combined with those derived from other sources. These maps are discussed by Dr. Weber in his "Narrative," and, except for the table of soundings, Lieut. Tydeman's monograph contains little but notes on navigation of the ordinary "sailing directions" type. We have been unable to find any account of temperature observations, although Dr. Weber makes considerable use of these, or of the collection of water-samples for chemical examination. The list of forthcoming monographs does not seem to include any further reports on physics and chemistry; but we can hardly suppose that these branches have not received full attention, and, in view of the remarkable results of the soundings made by the expedition, we look forward to a report on physical and chemical observations with the greatest interest.

AUSTRALASIA.

Among Pacific Islands.

'Chez les Cannibales: Huit Ans de Croisière dans l'Océan Pacifique à bord du Yacht *Le Tolna*.' By Count Rodolphe Festetics de Tolna. 4to, pp. iv., 407. *Illustrations and Maps*. Paris: Plon-Nourrit. 1903.

'Vers l'Écueil de Minicoy.' By Count Rodolphe Festetics de Tolna. 4to., pp. 395. *Illustrations and Maps*. Paris: Plon-Nourrit. 1904

These books, though bearing different titles, are in fact the two volumes of one and the same work, and may therefore be considered together. An only too common fault of books of travel at the present day is that the author gets over his ground at express speed, and has but little opportunity of acquiring any real knowledge of the country through which he travels. No accusation of this nature can be brought against the writer of the volumes before us, for no less than eight years intervened between the commencement of the yacht's cruise at San Francisco and her loss on the reefs of Minicoy. It is true that two of these years were spent in Japan, and lengthy visits were paid to other parts of the world which are familiar ground, but a large proportion of the time was occupied in cruising in the less-known waters of the Bismarck archipelago, the Solomon islands, the New Hebrides, Santa Cruz and various Melanesian islands. In mid-Pacific Fanning, Rakahanga, and many other islands were visited before reaching the usual goal of tourists, Tahiti and Samoa, at which latter place, it may parenthetically be remarked, the author had the good fortune to meet "Stevenson, *le célèbre écrivain américain*"!

Count Festetics himself navigated his little yacht—a schooner of 76 tons—and in a great part of his Melanesian cruise must have been in very imperfectly surveyed waters, notably on the east coast of Bougainville. His wanderings in these regions might have added a good deal to geographical knowledge, but unfortunately Count Festetics is in no sense a scientific traveller, and hence many golden opportunities have been lost. He describes what he sees, however, clearly and graphically enough, and manages to see a good deal, so that the ethnologist will find his pages by no means barren, still less the student of anthropophagy, a custom which appears to have an extraordinary fascination for the author. The chief merit of the book lies, nevertheless, not so much in its letterpress as in its illustrations. These, which are process blocks from photographs, are not only extremely numerous, amounting to nearly four hundred in number, but for the most part of unusual excellence. They are certainly the best examples as yet published of the islands extending from the Santa Cruz group to the Admiralty islands, and afford an abundance of types, many of which are admirable. The large size of the page, moreover, admits of correspondingly large subjects, such as the duk-duk ceremony, dances, etc., being well shown. When it is considered that in many cases the taking of these photographs must have been attended with no little risk, and was always under very unfavourable climatic conditions, their success is remarkable. They afford a fund of material for the ethnologist which alone contains more information than most books on this region, especially as a large number of articles of dress, ornaments, etc., etc., are figured.

The latter portion of the Tolna's cruise, culminating in her loss on Minicoy, calls for no special remark. It is in Melanesia, as we have already said, that the main interest of the book centres, and the leisurely character of the yacht's progress gave opportunities of observation such as the ordinary traveller seldom obtains. The result is a record of native manners and customs which, though not the contribution of a scientific observer, is by no means without value. Certain parts of it, however, ought never to have been written. That cannibalism exists in various parts of the world is an unpleasant fact which for the present has to be accepted, and within decent limits it is a legitimate subject for study at the hands of the ethnologist. But that any person calling himself a civilized being, as Count Festetics presumably does, could deliberately induce savages to take him on a cannibal expedition for the express purpose of seeing defenceless persons massacred and eaten would be absolutely incredible did we not find it recorded by the author himself *in extenso*, and without any apparent sense of shame or horror. Against actions such as these no protest can be too strong.

F. H. H. G.

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

ECONOMIC GEOGRAPHY.

'The Geography of Commerce.' By Spencer Trotter, M.D. New York: the Macmillan Company. 1903.

'Allgemeine und specielle Wirtschaftsgeographie.' By Dr. Ernst Friedrich. Leipzig: G. J. Göschen'sche Verlagshandlung. 1904.

"Die Fortschritte der Anthropogeographie" (1891–1902). By Dr. Ernst Friedrich. (Pp. 261–298 of vol. xxvi. of the *Geographisches Jahrbuch.*) Gotha: Justus Perthes. 1904.

The two books and the paper whose titles are given above can hardly fail to impress upon the reader how much it is to be desired that geographers should come to agree on some definition of geography that should clearly indicate its scope. The two books deal with the same subject, but they avowedly adopt different points of view. They both contain some rather vague and obscure generalizations in setting forth these different points of view. The differences in the method of treating the subject in the special portions of the two books are, nevertheless, not so great as one might expect from their professed differences in the manner of regarding it.

Trotter's work is one of a series entitled Macmillan's Commercial Series, edited by Cheesman A. Herrick, PH.D., Director of the School of Commerce, Philadelphia Central High School. According to the editor, "The 'Geography of Commerce' fixes the attention on the Earth as an agent in the production of commodities upon which human life depends." It "was prepared to make clear the present conditions of trade, but with the attention fixed primarily on the physical laws and facts by which it is influenced" (pp. xv.–xvi.). According to the author, "Geography, as distinct from physiography, includes not only the physical environment, but the human element as well," and "the geography of commerce sets forth the things that the Earth does or is made to do, in supplying the material needs of men" (pp. 1–2).

In the work of Dr. Friedrich the general section, which extends to 82 out of 329 pages (exclusive of index and preliminary matter), is that on which chief stress is laid by the author, who endeavours, with engaging modesty, but with the assured conviction natural to a serious scholar, to show that he has adopted an entirely new method of dealing with his subject matter, and that the adoption of this method is of prime importance is the study of economic geography. His point of view is set forth chiefly in the first thirty-three pages of his 'Wirtschaftsgeographie,' and is expounded in a similar manner in pp. 261–266 and 291–298 of vol. xxvi. of the *Geographisches Jahrbuch.* The chief distinction between his point of view and that of other writers on the subject is that he places man as a being carrying on economic activities in the foreground (p. 3), and gives a secondary place to natural conditions and relations (*Naturverhältnisse*). He expressly repudiates the conception of the function of economic geography "inaugurated" by W. Götz and followed by A. Kraus, S. Günther, and others, on the ground that they all start from the natural relations instead of the economic activity (*Wirtschaft*), which he describes as the one-sided anthropogeographical point of view (*Geog. Jahrbuch.*, pp. 296, 297), and he defines economic geography as "that branch of anthropogeography in the wider sense which has to consider the mutual relations between nature and man *essentially from the side of man*, without, however, neglecting the natural conditions" (p. 17). The italics represent the spread lettering by which the original lays special emphasis on this phrase. But even when this emphasis is duly recognized, this definition does not seem to indicate a point of view vitally different from that adopted by others who have treated the same subject. It is not essentially different from the clearer and more concise definition quoted above from Trotter, whose work, nevertheless, is stated to give the first place to the Earth. If undue emphasis is laid on the phrase to which Dr. Friedrich attaches special importance, the author may be taken to look upon economic geography rather as a branch of economics than of geography; yet he expressly states that the fact that considerations of place belong to the essence of this study distinguishes economic geography from political economy ('Wirtschaftsgeog.,' p. 17; *Geog. Jahrbuch.*, p. 266).

In order to ascertain what is distinctive in Dr. Friedrich's point of view, the further development of his idea must be considered. The being whose economic activity is the object of anthropogeography is a being in process of evolution. Like the lower animals, he is subject to restraints imposed by nature (*Naturzwang*), but there is this great distinction between the two, that whereas the lower animals carry on their struggle with the forces of nature to satisfy their wants by bodily attributes acquired through adaptation, man carries on the struggle also with the aid of resources outside of his body, tools and implements, which he acquires by economic activity (pp. 13, 14). The greater his command of such resources, the further is he removed from the restraint imposed by nature, the higher the economic stage to which he has risen (p. 19). Four stages are distinguished. The first is the stage of animal economy (*tierische Wirtschaft*). In this stage bodily adaptation prevails; implements are little used, and then only through an instinctive or reflex action. Man satisfies his wants merely by collecting, and is in complete dependence on nature in respect of place, time, quantity, and quality (p. 20). The second stage is that of instinctive economy (*instinktive Wirtschaft*), in which, under the guidance of instinct, man, with the aid of a greater number of implements, begins to free himself from the restraints of nature as regards time, place, quantity, and quality. Advances are made in stock-rearing and agriculture. The density of population at this stage, however, is mostly small, and subject to great changes in place and time. In the case of stock-rearers the settlements are constantly being changed, in that of agriculturists frequently (pp. 21, 22). A third and higher stage is reached when the experiences of each generation are systematically handed on to the next, either orally or, still better, in writing. This is the economic stage of tradition. The density of population among the agricultural nations in this economic stage is in all cases considerable, mostly extraordinarily great, but rather in consequence of the reduction in the wants of the individual than through the attainment of a high economic level. The advantages of commerce are fully utilized (*ausgenutzt*), and at the terminal and crossing points of the trade-routes the towns (*Siedelungen*), all fixed in situation (*durchweg fest*), swell to huge dimensions (pp. 22–24). The fourth stage is that of science, in which man, working with all the means placed at his disposal by experiment and insight, presses slowly but surely towards his ends, the complete knowledge of natural and human relations and their mutual reactions, and through that knowledge to the control of them. Economic activity, with the aid of science, attains a certainty and rationality which goes far beyond that of the economic stage of tradition. The density of population at this stage is high, in some cases very high, with a relatively high individual standard of living in consequence of the great intensity of the economic activity, and it is constantly increasing in correspondence with the steady increase in that intensity (pp. 24, 25). These four stages are not indeed sharply marked off from one another. There are transitions between them (p. 25), just as there are between animal and human activity (pp. 14, 15). Still they are sufficiently defined to be indicated by the author on one of the three maps at the end of his book, and considering all that is said about the fourth economic stage, one is somewhat surprised to see what an extensive area of the globe is coloured with its tint. The other two maps show respectively the distribution of the forms of economic activity (collecting of vegetable products, fishing, hunting, agriculture, stock-rearing, mining, manufacturing industries, transport, and the investment of capital), and the distribution of economic zones (based chiefly on climate).

It is to these maps, and the general considerations on which they are based, that the author attaches most importance in the study of economic geography; but it may well be questioned whether a map which, for example, places the more backward parts of Asia Minor in the same economic stage as China, with its highly productive agriculture maintained in parts by irrigation works as perfect as those of Egypt, its ancient and elaborate banking system, whose ramifications extend from the leading centres to the remotest provinces of the empire, its cities, which were hoary with antiquity when Rome was young, and some of which are still without the slums that form so lamentable a feature of the cities belonging to the regions in the "scientific" stage of economic development, is likely to be of much service to students of the subject with which the book deals.

In the special part of the work the application of the general considerations is not a prominent feature. That is left for the most part to the student. What characterizes this portion of the book is its extraordinary wealth of accurate detail, but with little attempt to indicate (apart from figures) the relative importance of the details, or to point out either geographical or other influences affecting the economic development. The facts are for the most part merely enumerated. The statement that the ports in British South Africa are "Port Nolloth, Cape Town (84,000 inhabitants), Mossel Bay, Port Elizabeth (23,000 inhabitants), East London (10,000 inhabitants), Port Natal (Durban), 48,000 inhabitants" (p. 281), is typical. Where explanatory notes are given, they are as frequently geographical in the proper sense of the term as explanations in which prominence is given to man as an economic agent.

In Trotter's work there is much less expenditure of systematizing energy, but in general a much more luminous, interesting, and instructive treatment of the matter in hand, and especially in the section on the United States, to which fully one-third of the book is devoted. In the selection and setting forth of details there is more regard to perspective than in Dr. Friedrich's work, and while the importance of local conditions and place relations is brought out with as much fulness as the limits of his work permit, the influence of man's action in modifying the value of such conditions and relations is indicated with more clearness and precision than in the vague generalizations of the German scholar. Trotter's work is illustrated by numerous maps and diagrams, many of them of the kind with which Cyrus Adams's work on *Commercial Geography* first made us familiar. Other excellent features of the work are the questions and topics for consideration and the lists of books to be consulted (sometimes with references to the precise pages), the more important being distinguished by stars and double stars, printed at the end of each chapter. Altogether this is one of the most valuable books on the subject that have been published, more particularly for American students. Both books are provided with good indexes.

G. G. C.

GENERAL.

VASCO DA GAMA.

'Le Comte-Amiral D. Vasco da Gama.' Par D. Maria Telles da Gama. Roger & Chernoviz, Paris. 1902. Pp. xxvi, 339, *with fifteen illustrations and a map of Da Gama's voyage.*

It would not be wise to expect too much from every volume with a noble title, an attractive exterior, a capacious page, and a loud-speaking preface written by a distinguished man. And so we will not expect too much from the book of D. Maria Telles da Gama. It is ushered in with words of commendation from Luciano Cordeiro; it is admirably printed, illustrated, and papered; it has all the appearance of furnishing us with an authoritative and up-to-date biography of a national hero; but its promise fades into something very dim in the way of performance when it is seriously examined. For one thing we must be grateful—for the complete French version of the famous 'Roteiro' of the voyage of 1497–9, which is given at the close of the volume (pp. 257–328). But the writer is surely mistaken in thinking that a translation of this invaluable authority justifies her in evading all independent treatment of the great expedition, and that seven pages of gossamer-like construction (19–26), mostly dealing with pleasant little stories bearing on the venture of 1497–9, can possibly be accepted as adequate treatment. The present volume, in fact, is not a serious life of Da Gama at all. It contains 339 pages, and of these barely 130 (with the 'Roteiro') can be considered as in any way biographical of D. Vasco. There is a dedication to Menelik, Emperor of Ethiopia, and a eulogy of that potentate; there is a lengthy comparison of the Portuguese Abyssinian expedition of 1541 and the British invasion of 1868; there is a vigorous *tu quoque* reply to English strictures on Portuguese misgovernment in India; there is a detailed and honest confession of the unfortunate translation of relics that were not Vasco da Gama's, from Vidigueira to Belem in 1880; but there is no attempt at a real life of the famous, stern, and cruel pioneer of European empire in India, based on fresh study of original material, or even on a careful representation of what has been hitherto put forward. Lastly, it is unfortunate that certain ungenerous criticisms on the first Christian dominion in East Indian seas, should lead to so large an expenditure of controversial ink in reply. 'L'Angleterre par système, contrairement à d'autres nations qui par habitude taisent leurs gloires,—porte aux nues ses exploits et dénigre les actions des autres peuples, si héroique soient-elles. . . . L'Angleterre épuise par des impôts brutaux une race décimée par la peste et par la famine et la conduit à la ruine et à la mort . . . 'If ever rebellion was justified, it is in British India. Never did a tyranny more intolerable oppress an unhappy people.' 'C'est un Anglais qui parle et qui a le courage de dire la vérité.' Rather more of what used to be called 'temper' is advisable in advancing even the best-founded accusations.

C. R. B.

THE MONTHLY RECORD.

EUROPE.

Yorkshire Coast Erosion.—Sir Clements Markham was present as a guest at a meeting of the East Riding Antiquarian Society, held at Hull on October 3, and spoke to the members of the important work to be done in the way of research into the changes to which the coasts of England have been subject within historical times, a study which, as our readers are aware, has been taken up on his initiative by the Research Department of the R.G.S. He referred in particular to the valuable help that might be rendered by antiquaries in the matter, in view of the light thrown on such changes by an examination of early records. The Yorkshire coast from Flamborough head to the Humber, and the tidal waters of the latter, had, he said, been chosen for the first section of the inquiry, and much might probably be learnt in regard to the encroachments of the sea in this region by an examination of monastic and other records, the Priory of Swine having formerly held estates on the Holderness coast. It was known that several villages whose names occurred on old maps had disappeared, though little information was to hand as to their exact positions or the dates of their disappearance. Among other lost areas was the port of Ravenspur, where Henry of Bolingbroke landed to usurp the throne. As regards the Humber, much might be elicited by a study of the long series of maps and charts from Saxton's Atlas down to the present day. The gradual increase in size of the sunken island might in this way be traced, while no less interesting would it be to study the changes in the lower courses of the rivers debouching in the Humber as far as tidal influence extended, with the morasses and islands which were in turn formed. In a paper subsequently read, Colonel Saltmarshe referred to changes which had taken place within the last century on the Humber and lower Ouse.

Projected Trans-Pyrenean Railways.—A note in the supplement to the *Tour du Monde* for September 3 describes the steps lately taken to bring to a practical issue the idea of through railway communication across the range of the Pyrenees which has been in the air for the last twenty years. In 1885 a convention was signed between the French and Spanish Governments for the purpose of furthering the construction of two separate lines, the one across the western part of the range, from Oloron to Jaca by the Col de Canfranc, the other further east, from St. Girons to Lerida by the Col de Salau. It was, however, never ratified, and no further practical steps were taken until last year, when a new joint commission was appointed to examine the question. The recommendations of this commission, which have been accepted by the two Governments and embodied in a new convention, are to the effect that three separate lines (including the two originally proposed) should eventually be constructed, but that the first to be taken in hand should be the newest project—that of a line from Ax-les-Thermes to Ripoll, affording a direct route from Toulouse to Barcelona, and also facilitating communication between France and Algeria by way of Carthagena and Oran. The next in importance is considered to be the Oloron—Jaca line, which will greatly improve the communications between the two capitals, the telegraph line between which already makes use of the route. The third line would involve more difficulties owing to the long section to be constructed on the Spanish side. The convention has not yet been ratified by the two chambers, and the question of cost has also still to be solved.

Migration from Hungary.—A work on 'Migration from Hungary,' by Dr. G. Thirring, Vice-Director of the Communal Statistical Bureau in Budapest, in the *Abrégé du Bulletin de la Société hongroise de Géographie* (1902) shows that, while the history of Hungarian emigration reaches back into the fifteenth century, it has never attained such dimensions as in the last few decades. In the early days it was directed principally towards the neighbouring lands of Austria, Rumania, and Bukovina, in the last of which there are still five Magyar villages. Magyars migrating to Rumania, on the other hand, are always absorbed in a short time into the life of the country. In the two decades from 1881 to 1900, the migration from Hungary has amounted to 380,000 souls, or 2·3 per cent. of the total population. Down to the present day the current of emigration in the eastern counties (Siebenbürgen) has been directed to Rumania; in the southern counties, to Bosnia and Servia; in the western counties, to Austria; and only from the northern counties has it found its way mostly to America. To specify the highest relative and the greatest absolute drainage of population in the different administrative districts, the county of Saros has in the course of these twenty years lost by emigration 26 per cent., or 43,000 of its inhabitants; while the county of Bács-Bodrog (in the south) has lost 75,000, or 15 per cent. In 1857 there were only 53,000 Hungarians dwelling in Austria, whereas in the year 1900 there were more than 270,000, 100,000 of them in Vienna alone. The emigration to America has set in only since the eighteenth century, and in 1841 the Hungarians founded in the State of Wisconsin the colony of Harasztyfalu, which now as Sauk City has long lost all trace of Magyar character. Not till 1877 did the emigration assume large proportions. It was directed especially to Pennsylvania, New York, and New Jersey, and that in consequence of strikes among American workers. The volume of emigration attained its first maximum from 1886 to 1892, and its second in the years subsequent to 1899, since which date Hungarians, by their cheap unskilled labour, have ousted other workers in various departments of industry, as, *e.g.*, in the coalfields of Pennsylvania. The Hungarian ranks, therefore, among the best hated of American immigrants, and the prohibitive measures put in force against objectionable immigration are aimed in part directly at Hungarians.

Recent Research on Glaciation in the Carpathians.—Following the example set in particular by Joseph Partsch, of Breslau, in his investigation of the high Tatra, a series of explorers have in other parts of the Carpathians been examining the traces of the glaciation of the Ice age. First and foremost, Partsch himself has continued his studies, first published in 1882, on glacial traces in the trans-Alpine mountains of Central Europe. In 1901, 1903, and 1904, he extended his examination to the lower Tatra, and the results obtained will probably be published shortly. Meanwhile he has given a first instalment in a paper read to the Silesian section of the Hungaro-Carpathian Union ("Wanderungen und Studien in der niederen Tatra"). He has now restored on a large scale the picture which this, the second highest chain of the upper Hungarian Carpathians (separated from the high Tatra by the broad valley of the upper Waag), must have presented during the Ice age. The glaciation of this chain, running as it does from east to west, was unevenly developed, being confined exclusively to the north side. In this respect it presents an analogy with the essentially one-sided ancient glaciation in the southern Carpathians and the mountains of the Balkan peninsula lying to the north and the north-east. The glaciers proceeded from the cirque-like valleys, which, in the western part of the chain, lie beneath the three highest peaks of the chain—Jumbir, 6710 feet; Chopek, 6570 feet; and Solisko, 6410 feet. This last, it may be said in passing, is the correct name for the peak misnamed Chabenec on the military maps. They were mostly valley-glaciers depositing their terminal moraines as far as 3·1 miles from the main ridge, which stood at a height of 2600 to 3300 feet above sea-level. Their traces are distinctly visible in the form of moraine-ridges, valley-steps, and small mountain lakes. In the southern Carpathians the traces of the Ice age have been studied more particularly by De Martonne (1898–1903), Schafarzick (1897), and Ludwig von Lóczy (1903). They were first brought to light in this region by Paul Lehmann, of Stettin, in 1830–1884, but the discovery was for a long time disputed by the Hungarians, though afterwards confirmed by Rumanian geologists. Many more such traces were found by De Martonne, as may be seen in his paper, "La période glaciaire dans les Karpates meridionales" (*Comptes Rendus*, ix. *Congrès géol. internat. de Vienne*, 1903, pp. 691–702). Lóczy, who has published a paper on this subject in the *Proceedings of the Hungarian Geographical Society* (1904), with isohypsometric map of the western part of the southern Carpathians (Retyezát) and isobathometric maps of some of the mountain lakes, counts in the whole of the southern Carpathians ninety such lakes, to which he too ascribes a glacial origin. A comparison of their situation in point of altitude, more especially with that of the "Meeraugen" in the high Tatra, leads him to the conclusion that in the Ice age the outer side of the entire Carpathian arc must have received a larger amount of precipitation than the inner. Cvijić, who, in a recent paper on the Balkan peninsula (*Mitt. Geog. Gesells.*, Wien, 1904), has drawn a parallel between its mountains and the southern Carpathians, finds that the two agree as regards the increasing altitude of the snow-line and the lessening intensity of the glaciation from west to east. In this connection he makes the interesting conjecture that, contrary to the opinion of leading geologists, the main basin of the northern Adriatic must have been occupied by water during the whole of the Ice age. On the other hand, he fits in the different glaciations into the stages of the Alpine Ice age laid down by Penck and Brückner. Both Cvijić in the Balkan peninsula and De Martonne in the southern Carpathians have observed a twofold glaciation, the second and smaller of which was limited to the well-developed cirque-valleys. It is evident that much exploring work still remains to be done in this connection, not only in the Retyezát, but also, probably, in other mountain groups, such as that which lies at the sources of the Theiss, the Howerla group, and others.

ASIA.

Lake Kosso-Gol.—Dr. A. Woeikoff gives, in *Petermanns Mitteilungen* (1904, No. 6), a note on a scientific examination, by S. Peretolchin, of Lake Kosso-Gol, the second in area of the lakes of Eastern Asia which has been the subject of a memoir (in Russian) in the *Trudi* of the Society of Naturalists in the University of Kazan for 1903. The length of the lake, which is six times as large as the Lake of Constance, is 83 miles, the greatest breadth 24½ miles, and the altitude above sea-level about 5470 feet. The western shore is generally steep, but the eastern much more gradual, with many bays. The river Eg, the outlet of the lake, is only some 20 yards wide and 3 feet deep. The maximum depth disclosed by five lines of soundings was 676 feet, but depths reaching 300 feet were found on all the sections, the drop from the shores being comparatively steep, and the greater part of the lake-floor fairly level. The mean depth is estimated at about 500 feet. Observations on the temperature at various depths were taken in August of 1897 and 1899, and July of 1900. In the first-named year a surface temperature of 59°·2

Fahr. was recorded in the northern part; in the second, 54½° in the centre (near Dola-Koi Island); and in the third, one of 46° in the south. At depths of 33 feet (above which in every case the most sudden drop occurred) and over, the differences were comparatively slight (temperature at 33 feet, 44°·6 in 1897, 43° in 1900; at 300 feet, about 38½° in 1899 and 1900). In the cold summer of 1902 the surface temperature was only 41° near Dola-Koi. Kosso-Gol belongs to Forel's type of lakes of temperate latitudes, *i.e.* the temperature in summer is above that of the maximum density, 39°·1 Fahr., in winter below. The lake freezes at the beginning of December, and becomes free from ice in June or July. Both water and ice are very transparent; the thickness of the latter reaches 3–5 feet. The air temperature is low on the shores, daily means above 55° not being recorded until the end of July.

The North-Eastern Passage.—It appears, from a telegram received by the Russian Hydrographical Department from Colonel Drizhenko, that the expedition for the exploration of the route to the mouths of the Ob and the Yenisei has concluded its work by a detailed survey of the western coast of the Yalmal peninsula. It has also described the Byelyi island, which is an important point on the route. The astronomical determinations of Colonel Drizhenko are of special interest, in that they show with what an accuracy the officer Ivanoff, who described the Yalmal coast in the thirties of the last century, made his astronomical determinations. The work of exploration and survey of the route to the mouths of the Ob and Yenisei, which has taken fully eight years, is now completed. It appears that under favourable weather conditions the whole distance from Arkhangelsk can easily be covered in seven days, to which eleven days must be added if the ship starts from St. Petersburg.

The Grand Canal of China.—Father Domin. Gandar, S.J., has published, as *Variétés sinologiques*, No. 4, a reprint of his historical and descriptive study of the Imperial canal. The earliest account of the canal is found in the writings of Confucius. Dug about 485 B.C., the first canal united the Yang-tse Kiang with the Hwai-ho across an interval of over 30 leagues. The history of its successive enlargements and transformations, illustrated by a series of diagrams, is followed through the period of the three kings, in which (24 A.D.) the waters were diverted through the lakes Tsin and Pé ma, and through the dynasties of Tsin, Swei, and Tang, ending under the Song dynasty in 1078. Lasting some 1563 years, the ancient canal attained the length of 435 miles, from Tsing-ho-hien to Hang-Chau. While the ancient canal was fed by the Yang-tse Kiang, flowing from south northwards, the new canal was fed by the Hwai-ho, flowing in an opposite direction—a change in the relief of the soil attributable, in part at least, to the action of the Hwang-ho. The current of events is traced from 1071, when the Yellow river, bursting its banks, changed its direction from north to south to throw itself eastwards into the Chang-ché-lo, down to the year 1289, when new works were begun, and in three years the navigable way from Hang-Chau to the Yellow river was continued to the capital of Kublai Khan. By this continuation of over 600 miles, the Imperial canal reached a total length of more than 400 leagues. Throughout its whole extent it is known as Yun-ho ("canal of transports") and Yun-liang ho ("canal of transport of tribute"). The northern part, to the north of the Blue river, much the busiest and most important, is divided into a south, a central, and a northern section. Two chapters, illustrated by diagrams, are devoted to the exacting labours involved in the maintenance of the canal under the successive dynasties of the Ming and the Tsing. Next follows an account of the state of the canal, 1850–1893; its actual service in the cause of navigation; its facilities and variati [illegible] bridges, which are purposely reduced to a minimum; its safety for purposes of navigation, etc. Two maps show the existing canal in two sections. Its total course measures 3630 li, of which 2010 fall to the distance between Tong-Chau and Peking.

Weihaiwei.—A recent colonial report on Weihaiwei gives meteorological returns showing that in 1903 rain fell in this "white man's climate" on seventy-two days, including snow on eighteen days, to the amount of 35·47 inches, a record rainfall for the last five years, exceeding that of 1902 by 6·63 inches. The wettest month, August, yielded 14·18 inches. The highest mean monthly temperature was 81° for August; the actual maximum, 92° in July; the lowest, 17° in January. The rainfall of the last two years shows the bridges on the coast and Chifu roads to be insufficient. The island of Liu Kung is reported to be extremely healthy, being cool in summer, sunny and bracing in winter; the atmosphere dry. In the summer of 1903, the maximum temperature did not exceed 86° Fahr. Among the improvements made in the island in 1903 is the construction of a sea-wall along the shore, and the laying out of the area behind it. On the mainland the main road from Half Moon bay to Flagstaff point, a length of 5 miles, has been metalled, while two new streets have been run through Port Edward. In 1903, 242 steamers of 244,940 tons entered the port, a 66-per-cent. increase over the shipping of 1902. The exports and imports show a proportionate increase, the export of ground nuts increasing from 918 piculs in 1902 to 10,847 in 1903, that of salt fish from 10 to 1392 piculs. The population of the leased territory (285 sq. miles) is about 150,000, including that on Liu Kung island, which is not more than 2000. As regards the resources of the territory, it is pointed out that there are about 85,000 acres planted with scrub oak, a suitable food for the silkworm, which might yield 4000 cocoons per annum. A flourishing fruit trade might also be established by the introduction of the best European varieties of fruits. The suitability of the territory for the growth of vines, field crops, forestry, shade trees, and white wax is also indicated.

AFRICA.

Captain Boyd Alexander in Nigeria.—Writing from Lokoja on July 28 of this year, Captain Boyd Alexander gave a short summary of the proceedings of his expedition for survey and zoological work in Nigeria (*Journal*, vol. xxiii. p. 255) down to that date. Some unforeseen difficulties and delays had occurred, arising principally from the illness of one or two members of his party; but these had recovered at the time of writing, and it was hoped that a renewed start for the first main objective of the expedition—Bornu—would shortly be made. Reaching Lokoja on March 24, the expedition at once prepared for the journey up the Benue to Ibi, which had been fixed upon as the first base. The two steel boats were put together, and a start was made on March 31 with these and five large canoes. The average depth of the Benue was then 3 feet, and there were many sandbanks, but the steel boats proved very satisfactory, the Hodgett principle adopted (that of having a curved-in bottom) * giving stability and buoyancy, and at the same time causing less resistance to the current, which ran in places at the rate of 6 miles an hour. The arrival at Ibi took place at the worst season (April—May) as regards health, though the best for survey and geological work, as the grass is still short and the air is not clouded by bush fires. From Ibi (where five clear nights favoured the astronomical observations) it was decided first to triangulate as far as Bauchi with a view to connecting this place with subsequent work in

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* The same principle was adopted with success, it will be remembered, for the steam-launch taken up the Zambezi by Major Gibbons.

Bornu. By a fortunate chance, some good sights were obtained on to the Murchison range, which came out clear and distinct one afternoon after heavy rain. By this means 60 miles of heavy bush country was bridged over, the points in the range being subsequently picked up during the triangulation. This was the work of Lieut. Claude Alexander and Mr. Talbot, but it was hampered, first by the illness of Mr. Talbot, afterwards by the famine then prevailing in the country; but good progress was eventually made, and the latest accounts stated that only one more station remained to be occupied before Bauchi should be reached. A good occultation was taken at Wase by Mr. Talbot, and the bearings of distant points in the hill country obtained from the remarkable rock at that place. Meanwhile, zoological work was done by the leader and Captain Gosling at Ibi, and a fine collection was obtained by the Portuguese assistant from the hills about Tarkum to the south. This man met with many of the Munchi people—an industrious race whose well-kept farms offer a great contrast to the slipshod methods of their northern neighbours, though they have hitherto shown themselves adverse to the coming of the white man. Like their neighbours, the Egbaras and Bassas, they are typical Bantus, and they show a remarkable resemblance, in dress, manners, and customs, to the Bubis of Fernando Po. Preparations were now made for the departure of the river column up the Gongola (or Gombe, as it is called by the natives), and the two boats, with a flotilla of canoes, left for this river on June 30, being probably the first transport boats to make its ascent. Ashaka, on its upper course (in 10° 26′ N., 11° 7′ E.) has been chosen as the next base. It lies centrally between the large towns of Kupto, Burmi, and Naffata, whence the necessary supplies can be drawn. The survey column was to move overland to Ashaka, whence it was proposed to take the bulk of the expedition across to the Komadugu, and descend this to Yo and Lake Chad, another column with supplies going by road to Kuka. Captain Alexander had meanwhile run down to Lokoja, but hoped to leave for Bauchi in a few days by the Loko-Keffi route, hoping to obtain some interesting zoological data *en route*, as the hills above Keffi may possibly be found to influence distribution.

A Characteristic Form of Surface in Africa.—All who have read the accounts of African travellers, descriptive of the surface features of the continent, must have been struck with the frequency of recurrence of a type of surface in which a generally level plain is broken here and there by isolated elevations (usually composed of granite or other ancient crystalline rocks), rising like islands above the general level of the country. For certain special regions attempts have been made (*e.g.* that of Dr. Dantz, in regard to German East Africa, referred to in vol. xx. p. 231 of the *Journal*) to explain the mode of origin of this form of surface; but few writers (if any) have taken a general survey of the whole continent from this point of view. This is now done by Dr. S. Passarge in the *Naturwissenschaftliche Wochenschrift* for July 17 last, in a paper which, though its conclusions are largely based on hypothesis, is suggestive and valuable as showing the importance of a further study of the question. After mentioning the various possible ways in which such a form of surface, which is found principally in the Sudan, East and South Africa, might originate * (by tectonic, marine, volcanic, or erosional agencies), Dr. Passarge deals in turn with different areas, each of which he considers to display a special type of the feature in question. Beginning with Bechuanaland, where he has himself studied it with special care, he finds the present surface can only be explained as a result of erosion—the mountain being outstanding masses of rock left by the action of denudation—and that this erosion can have been none other than wind-erosion acting under more or less desert conditions. Coming next to Adamawa (also known to him from personal observation), he finds a type which, though differing from that of Bechuanaland, can, he thinks, be explained as having originated in the same way, though subsequently modified by river erosion. In Kordofan, the original framework of which was considered by Dr. Linck (the latest scientific traveller to visit the country) to have been a mountain land seamed by deep valleys, Dr. Passarge likewise sees evidences of an old surface of wind-erosion, pointing to the survey under Prout in the seventies of last century as showing that the granitic detritus now spread over the surface overlies a stratum of mica-schist, which occurs at a remarkably even depth below the surface. He thus considers that the old plain of æolian denudation has been since covered over by detritus, obtained from the wearing down of the mountains. In regard both to Kordofan and the large areas of the Sudan composed of non-fossiliferous sandstone, he negatives the idea that the existing surface formations are the result of marine denudation, holding that they are the counterpart of the *lower* portion of the Nubian Sandstone, which has been thought to be of continental origin, and which was formed in Mesozoic times, before the Cenomanian influx of the sea in these regions. It will be seen that Dr. Passarge is perhaps too much inclined to reduce all the types to one original mode of formation, so that the suggested conclusion, that much of equatorial Africa was subject to desert conditions in Mesozoic times, rests at present, as he himself allows, on anything but a sure foundation. But the interest attaching to a further investigation of this form of surface in its bearing in the past history of Africa and the Earth as a whole, is clearly brought out by the paper.

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* As a general term for this type of landscape, Dr. Passarge uses the clearly descriptive if somewhat cumbrous expression "Inselsberglandschaft."

AMERICA.

Buried Ice-sheets in the Tundra of North America.—In the third number of the *Journal of Geology* for the present year, Mr. J. B. Tyrrell explains the formation and growth of buried ice-sheets examined by him in the Yukon territory. Between the glaciated coast and the Rocky Mountain ranges is a country of high hills and deep valleys. In the bottoms of these valleys flow streams flanked on one or both sides by alluvial deposits, from 10 to 100 feet in depth, consisting below of coarse sand and gravel; above this, of fine sands with peaty and vegetable matter; and, as topmost layer, of "muck" or sphagnum swamps. The surface of this region, whether formed of "muck," gravel, or rock in place, is almost everywhere permanently frozen. Here and there, however, are unfrozen channels through which issue springs from the sides of the hills, carrying water from the unfrozen depths to the surface. Some of these springs lie beneath the ordinary surface level. Let the flow from the spring be not large, and the ground be covered with a coherent mass of sphagnum bog, then the spring water, already at 32° Fahr., rises till, within the influence of the atmosphere above, it freezes. With the increasing cold of winter the ice continues to form downward. At length, a few feet below the surface, but still within the influence of the low external temperature, a plane of weakness, generally determined by a thin horizontal band of silt or fine sand, is reached in the frozen vegetable deposit. All outlet to the top being now permanently blocked, the water is forced along this plane, and there freezes. Increasing in extent, it increases also in thickness, until its bottom plane is beyond the reach of the low atmospheric temperature above. Thereafter it continues to increase in extent, but not in depth. With the advent of warm weather the growth of the ice-sheet ceases, but the cold spring water continuing to rise up beneath it has little power to melt it, and its "muck" covering, being an excellent non-conductor of heat, protects it from sun and wind, and prevents it from thawing. Such sheets of clear ice, more or less horizontal, attain a thickness of from 6 inches to 3 feet or more. In area they differ greatly. One observed by Mr. Tyrrell on the shore of Lake Daly, west of Hudson Bay, might underlie a square mile or more. Many in the bottom lands of the gold-bearing Klondyke creeks vary in length from 100 to 1000 feet, and in width from 50 to 200 feet.

A Journey round Mount McKinley.—The American polar traveller, Dr. F. A. Cook, describes in the *Bulletin* of the American Geographical Society (1904, No. 6) an expedition to Mount McKinley, the highest summit of North America, carried out by him in 1903, with a small party from New York and Seattle. Dr. Cook had set before him as an object of his ambition the ascent of the great mountain, but though this was not accomplished, a height of 11,400 feet was reached and the entire circuit of the mountain made, so that our knowledge of the features of the Alaskan range in which it stands has received some welcome additions. Landing at Tyonek, on Cook inlet, on June 23, the explorers started with fourteen pack-horses for a tramp of 500 miles to the west side of the range, which was chosen as the most promising for the first attempt. For thirty days they suffered from cold rains, and men and horses were tormented by mosquitoes; but on the far side of the range these disappeared, the weather improved, and game was everywhere abundant. On August 14 a base camp was pitched 14 miles north-west of the great mountain, which on this side showed, above 12,000 feet, an almost uninterrupted cliff of pink granite, with ridges running out to the north-east and south-west. The latter ridge seemed to give a possible route to the summit, and two attempts were made to ascend by it, but on both occasions insurmountable obstacles barred the way. The second attempt was made over the surface of the Peters glacier, which descends on this side, but the travellers were brought up at the foot of a nearly vertical granite wall of 4000 feet. It was too late to make an attempt from the north or east, but Dr. Cook and his companions made a circuit to the north-east, crossed the range, and then skirted its eastern face, returning to the coast by the Sushitna river. Mount McKinley is said to stand out as a giant peak from whatever side it is viewed. From the west it rises out of a great extent of low grassy country, while it is continued on both sides as a range 10,000 feet high—sharp, narrow, and crested with icy cornices. In its general appearance the mountain is likened to the crown of a molar tooth. Besides the great Peters glacier, which sweeps the whole western face, there are two vast glaciers on the east and south-east, one of which, Fidele glacier, is thought by Dr. Cook to be the largest of interior Alaska.

AUSTRALASIA AND PACIFIC ISLANDS.

Bellenden-Ker Range, Queensland.—A Queensland official report by Mr. A. Meston on an expedition carried out this year to Bellenden-Ker range, throws new light on its geography and flora and fauna. Starting in the north, near Behana creek, 20 miles south of Cairns, the range rises gradually into a ridge 1700 feet high. Thence dipping 300 feet in a saddle, it again rises to 2400 feet in Mount Toressa, the first peak in the range. Thence, after another dip of 600 feet, it rises in Mount Sophia to 4060 feet. Again descending 1000 feet, it then rises abruptly in the North peak to 5000 feet. Beyond this North peak, the range, gradually curving south-west and westwards, sends up four more peaks, ending in the southern and highest peak at 5200 feet. In its further course the range broadens out, and in this direction a spur connects it with the Bartle Frere range, dividing the waters flowing south into the Russell from those flowing north into the Mulgrave. The total length is about 18 miles. Clothed from apex to base in luxuriant jungle, the western slopes descend some 3000 feet in the first 3 miles, and 1200 feet in the next 3. The eastern slopes are also steep, but the vegetation is relatively poor. The yearly rainfall is about 200 inches. The whole range is composed of granite, traversed everywhere by quartz reefs and veins. Dense luxuriant scrub covers the whole area, the soil of which is composed entirely of decomposed vegetation. The steep spurs and deep ravines are covered by gigantic vegetation, and it is in the dark ravines of the western side, where no sunlight enters before 9 and 10 a.m., that the vegetation is rankest. Enormous trees grow from the base up to 4500 feet. On the south spur alone there is an incalculable quantity of splendid timber, a remarkable fact being its intense hardness, saplings of 6 inches diameter being as hard as iron bark in South Queensland. Starting as low as 2600 feet, the mangosteen tree showed no signs of fruit till at 4000 feet, but thence as far up as 4700 feet the trees were nearly all fruiting. As the result of his expeditions of 1889 and 1904, Mr. Weston concludes that Queensland possesses the most interesting flora and the most numerous and valuable wild fruits in the world. From his last expedition he brought down nearly a hundred kinds of fruits, not one of which is known outside the Bellenden-Ker range. Of these thirty-five are edible in their present wild state.

POLAR REGIONS.

Fossil Flora of the Antarctic: Erratum.—We regret that in the note on this subject in the August number of the *Journal* (p. 200), Dr. Nathorst's name was, by a slip of the pen, replaced in the latter part of the note by that of Dr. Andersson, who had been alluded to previously as the discoverer of fossil remains of plants in the Antarctic. As stated at the beginning of the note, the discussion of the questions involved by this discovery is from the pen of Dr. Nathorst, by whom the identifications alluded to in the latter part of the note were made, and whose name should therefore be read throughout this part in place of that of Dr. Andersson.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

The Proposed Indian Ocean Expedition.—As mentioned in our report of the Cambridge meeting of the British Association, an important expedition is shortly to be despatched by the Admiralty for the scientific examination of the Indian ocean on the lines followed by the *Challenger* Expedition in regard to the other great oceans. For want of such a detailed study in the case of the Indian ocean, our knowledge of the configuration of its floor, of the conditions of temperature and salinity of its waters, and of the distribution of life within it, is at present extremely defective, and all interested in such questions will learn with satisfaction that they are now likely to receive elucidation as a result of the proposed expedition. H.M.S. *Sealark* has been detailed for the purpose, and will, it is hoped, leave Ceylon in April, 1905, to commence operations. Permission has been given for two naturalists to accompany her, the first of whom, Mr. J. Stanley Gardiner (Fellow of Gonville and Caius College, Cambridge), is already well known to geographers for his researches in marine biology and allied subjects in the Pacific, and among the Maldive and Laccadive archipelagoes, extending in all over nine years. The second naturalist, Mr. Forster Cooper (also of Caius College), has spent nearly a year in the Maldives and in Ceylon. The programme laid down for the expedition is as follows. The *Sealark* will proceed first to the Chagos archipelago, where three months will be spent in sounding, dredging, etc. A line of soundings will then be run down to the Seychelles-Mauritius line, and an additional three months will be spent in thoroughly examining the submerged banks on that line, the Nazareth and Saya de Malha. Agalegas islands will then be visited, and the expedition will end at the Seychelles. The work of the expedition will be of special interest in view of the former land connection which almost certainly existed between India, Madagascar, and South Africa. In addition to the soundings, temperature and salinity observations will be made throughout, and samples of the bottom deposits taken. A special feature will be the examination of the general conditions of the intermediate depths, from 50 to 500 fathoms, with particular reference to their fauna and flora, and the formation of coral and other banks. Attention will also be paid to the distribution of littoral animals, both vertically and horizontally, as well as that of the pelagic fauna, this last with special reference to the larvæ of littoral forms.

Methods of determining Coastal Development.—Mensuration methods of determining geographical distinctions give useful results, provided they are obtained by legitimate processes, and are used with discrimination as a contribution to, and not as a complete solution of, geographical problems. The question of expressing coastal development numerically is an old one. Karl Ritter, regarding the coast as an indication of the penetrability of the land, expressed the coastal development in terms of the area of the land. The numerical expression used was in the ratio of the actual length of shore-line to the minimum possible perimeter, *i.e.* the length of the circumference of a circle enclosing the area in question. A second method is to compare the length of the actual shore-line with that obtained by joining the innermost or the outermost points by straight lines or by double tangents. A third method, recently employed by F. Schwind ("Die Riasküsten und ihr Verhältnis zu den Fjordküsten unter besonderer Berücksichtigung der horizontal Gliederung," Liepzig Dissertation, 1901), compares the length of the shore-line with that of a selected isobath, which has a much smoother course. A fourth method is to compare the areas of two surfaces, *e.g.* that of the mainland limited by a selected contour with that of the peninsulas and islands lying outside this contour, or the ratio of the areas between the equidistant lines landward and seaward of the shore-line. Prof. de Martonne has criticized these methods ("Le développement des côtes bretonnes et leur étude morphologique," *Travaux scientifiques de l'Université de Rennes*, vol. ii. part iii., 1903), and summarizes the desiderata for the numerical expression of coastal development as follows: (*a*) The results should give corresponding value for homologous coasts; (*b*) the values should be capable of arrangement in a series corresponding to the sequence of the phenomena determining the forms of the coast which they represent; (*c*) vertical as well as horizontal dimensions should be taken into account. He agrees with Ratzel ("Studien über Küstensaum," *Bericht. K. Sächs. Gesels. der Wissenschaft, Leipzig, phil.-hist. Klasse*, August 1, 1903, p. 205) that linear comparisons should be between the shore-line and a real contour-line, but he points out that the ratios for the great lobed coasts, *e.g.* anses of Britanny, will be almost indistinguishable from those for the alluvial (marsh) type. He suggests that a comparison of lengths with areas is the best, and that the area of such a belt as that between the contour-lines of +10 and −10, or +20 and −20 metres will yield the most fruitful results.

The Energy developed by Earthquakes.—Dr. R. von Kövesligethy, of Budapest, is responsible for an ingenious calculation of the work done by great earthquakes. Starting from the coincidence between periods of rapid displacement of the positions of the poles and of frequency of large earthquakes, and assuming that this is not a mere coincidence, but a relationship between the two, he finds that the irregularities in the movement of the poles represent an amount of work equal to the raising of a mass, equal to that of the Earth, through 1·2 millimetre at its surface by each of the 200 world-shaking earthquakes registered during the eight years 1895–1902 (*Die Erdbebenwarte*, iii. (1904), pp.

196–200). We may carry this calculation a little further, and find that the work done spasmodically by these earthquakes represents seventy-five billion (75,000,000,000,000) horse-power working continually, night and day.

The Age of Glacier-Ice.—In the 7th number of the *Geographische Zeitschrift* for the present year, Dr. Hans Reusch raises the question of the age to which glacier-ice may possibly attain in exceptionally well-sheltered spots, basing his remarks on a recent examination of a small Norwegian glacier (the Riings glacier) which presents some rather special features. Among these are the comparatively large area covered by the ice-stream in proportion to the small gathering-ground of the *névé;* the existence in the lower part of the glacier of a raised ridge, running parallel to its length; the extraordinary coarseness of the ice-grains, and the clearness of the stream which issues at the lower end, showing that erosion is practically at a standstill. The writer thinks that the glacier may be considered at present in a half "dead" condition, and from indications which he saw of the small annual amount of movement, even at the surface, he suggests that some of the existing ice may date back as far as to the Neolithic age. It cannot be said that his reasoning is entirely convincing, and a possible fallacy seems to consist in the idea that the rate of movement since Neolithic times must always have been as slow as at present.

GENERAL.

The Olive.—Following on his monograph, published a quarter of a century ago, on the date palm, Prof. Dr. T. Fischer has now, as a supplementary number to *Petermanns Mitteilungen*, published a monograph marked by like comprehensive scope, and like human interest, on the olive. The fruit of thirty years' personal observation and scientific study, this treatise is the most complete existing account of the olive in its history, distribution, and economic and cultural aspects. As is well known, the olive has from earliest times served the Mediterranean population in the way of food, religious rites, lamp oil, ointment for the hair and body, and as an article of export. Second neither to wheat nor the vine in respect of geographical range, range of time in human history, or of material and moral import, the olive is inseparably bound up with human culture, flourishing also in Mediterranean vocabularies and literatures—in Homer, Pindar, Æschylus, and the books of the Bible, etc. It figures prominently also in geographies, histories, and travellers' tales, from ancient times. A few figures may be quoted: Olive trees in Italy number 100 millions, and in Spain 300 millions. These figures will be better appreciated in comparison with the fact that in all Germany there are only 164 million fruit trees. Tunisia, in spite of its now being in vast part desert, possesses 20 million olives. In Corsica there are 36 millions. In California there were, in 1894, 425,000 olive-bearing and 1,360,000 young olive trees. In 1895, 800,000 young plants were transplanted. In Australia, in the eighties of last century, there were 53,776 olive trees, yielding 1411 gallons of oil. As a geographer, Prof. Fischer inclines to the view, which seems to have also the preponderance of botanical opinion in its favour, that the oleaster is not the olive tree grown wild. The oleaster ranges from the eastern border of Persia to the furthest south-west of Morocco, and reaches, though apparently only exceptionally, to the north of 40° N. The olive, on the other hand, is a strictly Mediterranean plant, ranging from Syria on the east westwards over all the Mediterranean lands, whence it has been transplanted to certain lands in North and South America, South Africa,* and Australia, rejoicing, like the Mediterranean, in a climate favourable to its culture. Prof. Fischer is confirmed in the view that the polar and altitudinal frontier of the olive coincides with that of the Mediterranean flora. The instructive map at the end, embodying almost exclusively the results of the author's personal investigations, would thus present a picture of the geographical range and distribution, not of the olive alone, but also of the most important representatives of the Mediterranean flora.

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* The author's remarks on what would have been done by the British in South Africa, in the hypothetical case of the Boers possessing olive orchards, seems somewhat uncalled for and out of place in a scientific treatise.

OBITUARY.

Mrs. Bishop.

The distinguished traveller, Mrs. Isabella Bishop, died at Edinburgh on October 7, after a fourteen months' illness, at the age of seventy-two years. Always more or less of an invalid, Mrs. Bishop accomplished an amount of work in out-of-the-way parts of the world which would have been no mean achievement even for the most robust, and for the extent and value of the information she brought home from her wanderings she may be ranked with the most accomplished travellers of her time, while among the many distinguished lady travellers who have come before the public during the past half-century, her title to the foremost place can hardly be challenged.

Mrs. Bishop was the eldest daughter of the Rev. Edward Bird, Rector of Tattenhall, Cheshire, her mother belonging to the Lawson family of Boroughbridge, Yorkshire. From her early years she suffered from ill health, and on this account remained more constantly in the society of her parents and the intellectual circle in which they moved than might otherwise have been the case, making long carriage expeditions with them, and thus acquiring an unusually intimate knowledge of many parts of Great Britain. After a short incumbency of St. Thomas's, Birmingham, her father, whose health had at this time given way, moved to the small country village of Wyton, in Huntingdonshire, and here at the age of sixteen Miss Bird made her first essay at authorship in the form of a pamphlet, published by a Huntingdon bookseller, dealing with the rival claims of free trade and protection, the latter of which she favoured. From this time she contributed more or less regularly to various periodicals, and a few years later, at the age of twenty-four, the first of her many books of travel appeared under the title 'An Englishwoman in America.' It was the outcome of a journey to Prince Edward island, undertaken two years previously under medical advice, and consisted of pleasantly written descriptions of her experiences, indited in the first instance for the benefit of her friends at home. This was also the beginning of her long association as an author with the publishing house of Mr. Murray, which was maintained to the end of her literary career.

Unlikely as it might seem at first sight, it was her continued ill health which was really responsible for the extent and variety of her travels, for notwithstanding the fatigues and positive hardships which they frequently—especially the later of them—involved, she seemed able only to obtain relief when in constant movement, no doubt through the bracing effect of change of scene, and the alertness of all the faculties called out by her venturesome enterprises. Her next two books, published in 1873 and 1874, described her experiences in the Sandwich islands and in the Rocky mountains, in both of which she had spent some time during prolonged journeys, which extended also to Australia and New Zealand. Her more serious travels, all of them more or less connected with the East, began a few years later with a visit to Japan, where she penetrated into districts hardly, if at all, known to the European world, and on which she shed a valuable light from the intimate way in which she mixed with the people, and the keen powers of observation which she brought to bear on all she saw. Her volumes, published in 1880, under the title "Unbeaten tracks in Japan," described extensive routes in the main island, which she crossed from the capital to Niigata, afterwards traversing much of the wild northern interior and making her way to the shores of the Tsugaru strait. Crossing over to Yezo, she penetrated to the interior settlements of the Hairy Ainos, of whose characteristics and peculiarities she was thus able to present a vivid picture. In this and in all her subsequent journeys, she chose for the scene of her studies countries which were coming into public notice, and her narratives, which embodied the results of much careful inquiry, and showed considerable power of insight into the political, moral, and religious conditions of the populations among which she moved, were thus of distinct practical interest at the time of their appearance.

In 1881 Miss Bird married Dr. John Bishop, of Edinburgh, and during the few years of her married life, spent for the most part in that city, her geographical activity was temporarily in abeyance, though she published in 1883 the volume entitled 'The Golden Chersonese and the Way thither,' describing her visits to Southern China and the Malay peninsula. She had previously brought out, anonymously, a pamphlet describing in a realistic way, under the title 'Notes on Old Edinburgh,' the conditions of life in some of the slums of that city. Becoming a widow in 1886, she resumed her Eastern travels, this time turning her attention to the nearer countries of Persia and Asiatic Turkey. The journeys she made in these countries were perhaps the most adventurous of all her many wanderings, and much hardship was involved owing to the great cold and the difficult mountain regions through which much of the way led. The most remarkable journey was that made in 1890 through the Bakhtiari country and Luristan to Lakes Urmi and Van, in which to the physical dangers encountered were added those arising from the wild and turbulent inhabitants. The narrative of these journeys appeared in two volumes in 1891. Shortly afterwards she published a short account of journeys in Kashmir and Ladak carried out in 1889.

Between 1894 and 1897 Mrs. Bishop paid four different visits to Korea, on one of which she ascended both branches of the Han river, crossed the Diamond mountains with their Buddhist monasteries, and reached Wensan on the east coast. In her two volumes, 'Korea and her Neighbours,' published in 1898, she supplied much information on the internal conditions of Korea, giving also an account of the state of affairs in Manchuria, which she had visited in 1894. Her next work, 'The Yangtze Valley and Beyond' (1899), described a boat journey up the Yangtse and a land route through Sechuan to the district of the aboriginal Miao-tze tribes, into which she penetrated further than any of her predecessors. On one occasion during this journey she was in some danger at the hands of an infuriated Chinese mob. The book was profusely illustrated from her own photographs. Mrs. Bishop's last foreign adventure consisted in a journey in Morocco in 1901, during which she visited the Atlas mountains, but of this she published no detailed account. In 1903, her health becoming worse, she retired to a nursing institution in Edinburgh, and though she subsequently rallied somewhat, she was unable to regain her strength, becoming gradually weaker until the end came.

Mrs. Bishop was keenly interested in missions, though a candid critic where criticism seemed called for. Medical missions especially evoked her sympathy, which took a tangible form in the erection, at her own expense, of various hospitals in the East. She herself ministered to some extent to the medical needs of the peoples among whom she travelled, and to these services, and to the sympathy she always showed in her dealings with the less civilized races, must be ascribed much of her success. While her principal interest always centred in the peoples she met with, she was also keenly impressed by natural scenery, of which her works contain many vivid descriptions. She became a Fellow of the R.G.S. in 1892, being among the twenty-two ladies admitted to membership in that year.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Col. = Colonies.
Com. = Commerce.
C. R. = Comptes Rendus.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
Jb. = Jahrbuch.
k. u. k. = kaiserlich und königlich.
M. = Mitteilungen.

Mag. = Magazine.
Mem. (mém.) = Memoirs, Mémoires.
Met. (mét.) = Meteorological, etc.
P. = Proceedings.
R. = Royal.
Rev. (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Adriatic Sea—Tide. *M.K. u. K. Militärg. I.* 23 (1903): 81–132. **Sterneck.**
Die Höhe des Mittelwassers bei Ragusa und die Ebbe und Flut im adriatischen Meere. Von Dr. R. v. Sterneck. *With Map and Diagram.*,

Albania. *M.K.K.G. Ges. Wien* 47 (1904): 2–10. **Ippen.**
Ueber die geographischen Namen in Albanien. Von T. A. Ippen.

Alps. *Juhrb. Schweiz. Alpenclub* 39 (1903–1904): 298–314. **Forel, Lugeon, and Muret.**
Les variations périodiques des glaciers des Alpes suisses. Par Dr. F. A. Forel, Dr. M. Lugeon, E. Muret. Vingt-quatrième rapport. 1903.

Alps. *M. Deutsch. u. Österreich. Alpenv.* (1904): 157–159. **Schmolz.**
Die Bestimmung der Baum- und Krummholzgrenzen in den Ostalpen. Vorläufige Mitteilung von K. Schmolz.

Alps—Crystal-seekers. **Königsberger.**
Jahrb. Schweiz. Alpenclub 39 (1903–1904): 262–297.
Das Strahlen und die Strahler. Von Dr. J. Königsberger. *With Map and Illustrations.*

Alps—Historical. **Meyer von Knonau.**
Jahrb. Schweiz. Alpenclub 39 (1903-1904): 196-211.
Die Bedeutung der Alpen um den Gardasee für den Kampf Bonapartes um Mantua 1796 und 1797. Von G. Meyer von Knonau.

Austria. *G.Z.* 10 (1904): 332-343. **Frech.**
Bau und Bild Österreichs. III. Die Karpathen. IV. Die Ebenen Osterreichs. Von Prof. Dr. F. Frech. *With Sketch-map and Plate.*

Austria-Hungary. **Peucker.**
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Études sur l'Évolution des Rivières belges. Par J. Cornet (Extrait des *Annales de la Société géologique de Belgique*, t. xxxi., *Memoires.*) Liège: Imp. H. Vaillant-Carmanne, 1904. Size 10 × 6½, pp. 242. *Presented by the Author.*

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United Kingdom—Yorkshire. [**Murray.**]
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This edition has been considerably extended and revised throughout, improvements and additions being also made to the maps.

ASIA.

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Some remarks on the Nomenclature of Ossetia and adjacent countries, with special reference to Dr. Merzbacher's map. By J. F. Baddeley.

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P. Pjatnizky. Geologische Untersuchungen im Centralkaukasus. I. Zwischen dem Elbrus und der ossetinischen Militärstrasse. Vorläufige Mittheilung. [In Russian.] *With Plates.*

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Through the Highlands of Siberia. By Major H. G. C. Swayne. London: Rowland Ward, 1904. Size 9 × 6, pp. xiv. and 260. *Map and Illustrations. Price 12s. 6d net.*

An account of a trip mainly for purposes of sport, but of interest from the picture which it presents of a part of the world not too well known to English readers.

Russia—Siberia—Altai. *Globus* 85 (1904): 313–318. **Brecht-Bergen.**
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Le Siam Ancien. Par É. Aymonier.

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Further India; being the story of exploration from the earliest times in Burma, Malaya, Siam, and Indo-China. By Hugh Clifford, C.M.G. London: Lawrence & Bullen, 1904. Size 9 × 6, pp. xii. and 378. *Maps and Illustrations. Price 7s. 6d. Presented by the Publishers.* [To be reviewed.]

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Dar-ul-Islam. A record of a journey through ten of the Asiatic provinces of Turkey. By Mark Sykes. With Appendix by J. H. Smith, and Introduction by Prof. E. G. Browne. London: Bickers & Son, 1904. Size 9½ × 7, pp. xxiv. and 294. *Maps and Illustrations. Price* 15*s*.

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See note in Monthly Record (*ante*, p. 590).

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The East Africa Protectorate as a European Colony. By Sir C. Eliot, K.C.M.G.

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Notes on a Journey through East Africa and Northern Uganda. By Major Powell-Cotton. *With Map and Illustrations.*

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Ueber die Vegetationsverhältnisse des Somalilandes. Von A. Engler. *With Map.*

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On the historic cartography of the region explored by Lenfant.

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A Contribution to the Study of the Interglacial Gorge Problem. By G. C. Matson. *With Illustrations.*

United States—Historical. **Hulbert.**
Historic Highways of America. By A. B. Hulbert. Vol. 8.—Military Roads of the Mississippi Basin. The Conquest of the Old North-West. Vol. 9.—Waterways of Westward Expansion. The Ohio River and its Tributaries. Vol. 10.—The Cumberland Road. Vols. 11 and 12.—Pioneer Roads and Experiences of Travelers (vols. i. and ii.). Cleveland, Ohio: The Arthur H. Clark Company, 1903–1904. Size 8 × 5½, pp. (vol. 8) 238; (vol. 9) 220; (vol. 10) 208; (vol. 11) 202; (vol. 12) 202. *Maps and Illustrations.*

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The Alps of Montana. By F. E. Matthes. *With Map and Illustrations.*

United States—New Hampshire. *Appalachia* **10** (1904): 299–303. **Emerson.**
Note on Glacial Topography in Central New Hampshire. By P. Emerson.

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Drainage modifications in South-Eastern Ohio and adjacent parts of West Virginia and Kentucky. By W. G. Tight. (United States Geological Survey, Professional Paper No. 13.) Washington, 1903. Size 11½ × 9, pp. 112. *Maps and Illustrations. Presented by the U.S. Geological Survey.*

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Archæological Researches on the frontier of Argentina and Bolivia in 1901–1902. A Preliminary Report dedicated to the XIVth International Congress of Americanists at Stuttgart, 1904. By Eric von Rosen. Stockholm: Ivar Hæggström, 1904. Size 9½ × 6½, pp. 14. *Map and Plates.*

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A List of Books, Magazine Articles, and Maps relating to Paraguay. Books, 1638–1903. Maps, 1599–1903. Prepared by J. S. Decoud. A Supplement to the Handbook of Paraguay, published in September, 1902, by the International Bureau of the American Republics. Washington, 1904. Size 9 × 6, pp. 54.

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Sur les hauts plateaux de l'Amérique du Sud. Par M. le comte Georges de Créqui-Montfort. Par F. Lemoine.

See note in the *Journal* for April, 1904 (p. 525).

South America—Rivers. *Jahresb. G. Ges. Bern* 18 (1900-1902): 192-209. **Reindl.**
Die Schwarzen Flüsse Südamerikas. Von Dr. J. Reindl.

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POLAR REGIONS.

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Neues aus der amerikanischen Antarktis. Von W. Krebs. *With Map.*

On the work of the Swedish and Scottish expeditions.

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The writer holds with Balch that it would be premature to remove Termination Land entirely from the map, though its position may differ from that supposed by Wilkes.

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See note in the Monthly Record for September (p. 353).

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An old story of Arctic Exploration.

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Spitsbergen. **Leclercq.**
Les explorateurs du Spitzberg, par J. Leclercq. (Extrait des Bulletins de l'Académie royale de Belgique (classe des lettres, etc.) No. 5 (mai), 1904.) Bruxelles, 1904. Size 9 × 6, pp. 303-346.

Spitsbergen. **Leclercq.**
Une croisière au Spitsberg sur un yacht polaire. Par Jules Leclercq. Paris: Plon-Nourrit et Cie., 1904. Size 7½ × 5, pp. iv. and 292. *Map and Illustrations. Presented by the Author.*

The author emphasises the present accessibility of Spitsbergen to the Tourist and its scenic beauties. Besides describing his own visit, he sketches the history of European relations with the islands.

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Die stereophotogrammetrische Terrainaufnahme. Von A. Freiherrn von Hübl. *With Plates.*

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The Sanding-up of Tidal Harbours. By A. E. Carey. *With Plans.*

Earthquakes and Geology. *C. Rd.* **139** (1904): 318-319. **Ballore.**
La sismicité, critérium de l'âge géologique d'une chaîne ou d'une région. Note de M. de Montessus de Ballore.

Glaciers. **Reid and Muret.**
Les variations périodiques des glaciers. Neuvième Rapport 1903, rédigé par Dr. H. F. Reid et E. Muret. (Extrait des *Archives des Sciences physiques et naturelles*, t. xviii., 1904.) Genève: Georg & Cie., 1904. Size 9 × 6, pp. 36.

Gravity Determination. *Rev. G. Italiana* **11** (1904): 65-72, 146-160. **Magrini.**
I recenti progressi nelle determinazioni relative di gravità e la loro importanza per la geofisica. Memoria dell Dott. G. P. Magrini.

Meteorology. *Meteorolog. Z.* **21** (1904): 273-276. **Wegener.**
Die Temperatur in 1000*m* Seehöhe nach den Aufzeichnungen am Aeronautischen Observatorium des Königl. Meteorologischen Instituts bei Berlin. Von K. Wegener.

Meteorology—Fog. *Quarterly J.R. Meteorolog. S.* **30** (1904): 211-218. **Cohen.**
One Cause of Autumn Mists. By J. B. Cohen, PH.D. *With Diagram.*

The cause alluded to is the descent of cold air from upper levels to valley bottoms.

Meteorology—Pressure. *Symons's Meteorolog. Mag.* **39** (1904): 62-65. **Bonacina.**
The varying distribution of Atmospheric Pressure over the Surface of the Earth. By L. Bonacina.

Oceanography. *C. Rd.* **138** (1904): 1398-1400. **Monaco.**
Sur la 5^e Campagne Scientifique de la *Princesse Alice II.* Note de S. A. le Prince Albert de Monaco.

Oceanography. *B. Musée Océanograph. Monaco*, No. 11 (1904): pp. 30. **Richard.**
Campagne Scientifique du yacht *Princesse-Alice* en 1903. Observations sur la Sardine, sur le Plankton, sur les Cétacés, sur des filets nouveaux, etc. Avec résumé esperanto. Par le Dr. J. Richard.

Oceanography. *B. Musée Océanograph. Monaco*, No. 12 (1904): pp. 8. **Thoulet.**
Mesure des courants marins au moyen de l'analyse physique et chimique d'échantillons d'eaux récoltés en séries. Par J. Thoulet. *With Diagrams.*

Oceanography—Atlantic. *Ann. Hydrographie* **32** (1904): 277-287. **Schott.**
Die grosse Eistrift bei der Neufundlandbank und die Wärmeverhältnisse des Meerwassers im Jahre 1903. Von Dr. G. Schott. *With Diagrams.*

Oceanography—Indian Ocean. *Z. Ges. Erdk. Berlin* (1904): 371-373. **Schott.**
Zur Frage der Tiefenverhältnisse zwischen Crozet-Inseln und Kerguelen. Von Dr. G. Schott.

Oceanography—Tides. **Almagià.**
Riv. G. Italiana **10** (1903): 480-493, 538-545; **11** (1904): 13-23.
La Dottrina della Marea nell' antichità classica. Memoria di Roberto Almagià.

Petroleum. *J. Franklin I.* **157** (1904): 443-454. **Coste.**
Volcanic Origin of Oil. By E. Coste.

The writer argues in support of his theory that petroleum is inorganic in origin, and the result of solfataric emanations.

Phytogeography—Olive. *Petermanns M., Ergänzungsh.* 147 (1904): pp. 88. **Fischer.**
Der Ölbaum. Seine geografische Verbreitung, seine wirtschaftliche und kulturhistorische Bedeutung. Von Prof. Dr. T. Fischer. *With Map.*

See *ante*, p. 595.

Terrestrial Magnetism. *Sitzb. K.B.A.W. München* (1904): 29–39. **Messerschmitt.**
Das magnetische Ungewitter vom 31. Oktober 1903. Von J. B. Messerschmitt. *With Diagram.*

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Cables. **Lenschau.**
Das Weltkabelnetz. Von Dr. T. Lenschau. ('Angewandte Geographie,' I. Serie, 1 Heft.) Halle a. S.: Gebauer-Schwetschke Druckerei, 1903. Size 10 × 6½, pp. 74. *Map.*

Historical—Early Voyages. **Hakluyt.**
The Principal Navigations, Voyages, Traffiques and Discoveries of the English Nation. By Richard Hakluyt. Vols. vii.–viii. Glasgow: James MacLehose & Sons, 1904. Size 9 × 6, pp. (vol. vii.) xvi. and 466; (vol. viii.) xiv. and 486. *Portraits and Maps. Presented by the Publishers.*

Historical—Quiros' Voyages. **Markham.**
The Voyages of Pedro Fernandez de Quiros, 1595–1606. Translated and Edited by Sir Clements Markham, K.C.B. 2 vols. London: Printed for the Hakluyt Society, 1904. Size 9 × 6, pp. xlviii. and 556. *Maps. Presented by the Hakluyt Society.* [To be reviewed.]

Historical—Solís. **Quevedo.**
Juan Díaz de Solís. Estudio histórico. Por S. A. Lafone Quevedo. Buenos Aires, 1903. Size 10 × 6½, pp. 36. *Presented by the Author.*

History of Geography. **Weule.**
Geschichte der Erdkenntnis und der geographischen Forschung zugleich Versuch einer Würdigung beider in ihrer Bedeutung für die Kulturentwicklung der Menschheit. Von Prof. Dr. Karl Weule. Berlin: Bong & Co., 1904. Size 12 × 8½, pp. xii., 180, and 256. *Maps and Illustrations. Presented by the Publishers.*

History of Navigation. **Traeger.**
Zur Forschung über alte Schiffstypen. C. Schiffsfahrzeuge in Albanien u. Macedonien. Von P. Traegar. (Separatabdruck aus dem Correspondenz-Blatt der Deutschen anthropologischen Gesellschaft. Nr. 4. u. 5, 1904.) Size 11 × 8½, pp. 15–28. *Illustrations. Presented by the Author.*

Political—Anglo-French Agreement. *Rev. Française* **29** (1904): 257–276. **Vasco.**
L'accord colonial Franco-Anglais. Par G. Vasco. *With Maps.*

Population—Maps. **Brückner.**
Ueber Karten der Volksdichte. Von Prof. Dr. Ed. Brückner mit einer Karte der Volksdichte des bündnerischen Rheingebietes, von Dr. H. Zivier. (Separatabdruck aus der "Z. für schweizerische Statistik," 1904.) Size 11¼ × 9, pp. 6. *Presented by the Author.*

Sociology. *Rep. S. African Assoc.* (1903): 462–479. **Fremantle.**
The Sociology of Comte, with special reference to the Political Conditions of Young Countries. By H. E. S. Fremantle.

BIOGRAPHY.

Brunel. *Mouvement G.* **21** (1904): 352–355. **Leclercq.**
Olivier Brunel, un navigateur belge dans les régions boréales au XVI^e^ Siècle. Par J. Leclercq.

Brunel undertook a voyage to the north in 1584, and may be considered to have shown the Dutch the way to the far northern seas.

Cabot. *Rev. G. Italiana* **11** (1904): 177–184. **Gribaudi.**
Ancora sulla patria di Giovanni Caboto. Prof. P. Gribaudi.

Coillard. *South Africa* **63** (1904): 49. **Gibbons.**
The late Rev. François Coillard. By Major A. St. H. Gibbons. *With Portrait.*

General. **Wolkenhauer.**
Geographische Nekrologie für die Jahre 1902 and 1903. Von Prof. Dr. W. Wolkenhauer. (From H. Wagner's *Geogr. Jahrbuch*, xxvi. Bd., 1904.) Size 8½ × 5½, pp. 423–446. *Presented by the Author.*

Harness. **Collinson and Webber.**

General Sir Henry Drury Harness, K.C.B., Colonel Commandant Royal Engineers. The Material for this Memoir was collected and arranged by the late General Collinson and edited by General Webber, C.B. London: 1903. Size 9 × 6, pp. viii. and 296. *Presented by the Royal Engineers Institute.*

This distinguished Engineer officer took part in the siege and capture of Lucknow during the Mutiny, after which he was for five years Director of the Royal Engineer School at Chatham, in which he inaugurated some important reforms.

Hartl. *M.K. u. K. Militärg. I.* 23 (1903): 41–47. **Sterneck.**

Oberst Dr. Heinrich Hartl. Von Dr. R. von Sterneck.

This well-known geodesist died in April 3, 1903.

Stanley. *J. African S.* 3 (1904): 449–463. **Johnston.**

Stanley: A Biographical Notice. By Sir H. H. Johnston. *With Portrait.*

Stanley. *Deutsch. Rundschau G.* 26 (1904): 470–472. ——

Henry M. Stanley. *With Portrait.*

GENERAL.

Almanac. ——

The American Ephemeris and Nautical Almanac for the year 1907. Washington, Bureau of Equipment, 1903. Size 10½ × 7½, pp. viii. and 602. *Diagrams.*

Babylonia and Egypt. **Geere.**

By Nile and Euphrates. A Record of Discovery and Adventure. By H. V. Geere. Edinburgh: T. & T. Clark, 1904. Size 9 × 6, pp. xii. and 356. *Maps and Illustrations. Price 8s. 6d. net. Presented by the Publishers.*

The author went out to the East in 1895 as a member of the Expedition of the University of Pennsylvania for excavations at Nippur. The present volume gives a readable account of his experiences, with sketches of places and people.

Bibliography. **Raveneau.**

Annales de Géographie. XIII^{e} Bibliographie Géographique Annuelle, 1903. Publiée sous la direction de L. Raveneau. Paris: A. Colin, [1904]. Size 10½ × 6½, pp. 320.

Bibliography. **Wright.**

Catalogue of the London Library, St. James's Square, London. Supplement 1 (1902 and 1903). By C. T. Hagberg Wright, LL.D. London: Williams & Norgate, 1904. Size 11 × 8½, pp. 180. *Presented by the London Library.*

British Empire—Cotton. *Scottish G. Mag.* 20 (1904): 354–371. ——

Cotton Cultivation in the British Empire and Egypt. *With Map.*

Geography. **Davis.**

Geography in the United States. An Address by Wm. Morris Davis, Vice-President and Chairman of Section E for 1903, before the Section of Geology and Geography, American Association for the Advancement of Science, St. Louis Meeting, December, 1903—January, 1904. Washington, 1903. Size 10 × 6½, pp. 32.

German Colonies. ——

Die deutsch Kolonial Gesetzgebung. Sammlung der auf die deutschen Schutzgebiete bezüglichen Gesetze, Verordnungen, Erlasse und internationalen Vereinbarungen mit Anmerkungen, Sachregister. Siebenter Teil, 1903. Berlin: E. S. Mittler und Sohn, 1904. Size 9½ × 6½, pp. xii. and 330.

Livingstone College. ——

Livingstone College Year-Book [1904], containing Hints to Travellers in matters of Health, Outfit, and Travel. Travellers' Health Bureau, Livingstone College, Leyton, E. Size 7½ × 5, pp. 96. *Illustrations. Price 6d.*

Contains abundant evidence of the excellent work done by the College.

Oxford—Daubeny Laboratory. **Günther.**

A History of the Daubeny Laboratory, Magdalen College, Oxford. To which is appended a list of the Writings of Dr. Daubeny, and a Register of the Names of Persons who have attended the Chemical Lectures of Dr. Daubeny from 1822 to 1867; as well as of those who have received instruction in the Laboratory up to the present time. By R. T. Günther. With a Preface by the President of

Magdalen. London: H. Frowde, 1904. Size 9 × 6, pp. viii. and 138. *Plates. Price* 5*s. net. Presented by the Author.*

The laboratory was originally founded in 1847 by Dr. Daubeny, one of the pioneers of Science at Oxford. The book describes the work done at the laboratory since its foundation, and gives an account of the meteorological records kept, with tables of observations of the temperature of the river Cherwell from 1882 onwards.

Units of Length, etc. **Warren.**

The Ancient Cubit and our Weights and Measures. By Lieut.-General Sir C. Warren, G.C.M.G., etc. London: Palestine Exploration Fund, 1903. Size 7½ × 5, pp. xx. and 132.

The author endeavours to trace the origin of existing weights and measures to the Babylonian cubit.

Year-Book. **Wagner.**

Geographisches Jahrbuch. XXVI. Band, 1903 . . . herausgegeben von H. Wagner. Zweite Hälfte. Gotha: Justus Perthes, 1904. Size 9 × 6, pp. 249–496.

This part treats of recent progress in various branches of general geography, including anthropogeography, geographical meteorology, the science of map-projections, etc.

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

England and Wales. **Ordnance Survey.**

Ordnance Survey of England and Wales:—Sheets published by the Director-General of the Ordnance Survey, Southampton, from September 1 to 30, 1904.

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25-inch—County Maps:—

Brecknockshire, XV. 4, 7, 10, 11, 12, 13, 14, 15, 16; XX. 4, 8; XXI. 1, 2, 3, 4, 5, 9, 13; XXII. 16; XXVII. 1, 2, 3, 4, 5, 6, 9, 10, 11, 12, 14, 15, 16; XXVIII. 5, 9, 10, 13, 14, 16; XXXIII. 2, 3, 4, 6, 8, 10, 12, 14; XXXIX. 11, 12, 15; XL. 9, 13, 15; XLI. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12; XLV. 10, 11, 12; XLVI. 1, 2, 5, 6, 7. **Devonshire**, VIII. 11, 12, 15, 16; IX. 13, 16; XII. 3, 4, 7, 8 (XII. 13 and XIIA. 16);

XIII. 1, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16; XIV. 1, 9, 10, 14; XX. 2, 3, 4, 5, 6, 7, 8; XXII. 14; XXXII. 3, 4, 7, 8; XXXIII. 1, 2, 5, 6; XXXIV. 1, 2, 3, 5, 6, 7. **Herefordshire**, XXXVII. 3. **Leicestershire**, VI. 16; LII. 16. **Lincolnshire**, CXXII. 6; CXXXI. 5, 6, 8, 9, 10, 11, 12, 13, 14, 15, 16; CXL. 2, 4, 5, 6, 7, 8, 9, 13, 14, 15, 16; CXLI. 1, 4, 5, 6, 8; CXLII. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 16; CXLIII. 1, 4, 8, 10, 12, 13, 14, 15, 16; CXLIX. 1, 2, 4, 5, 6, 9, 10, 11, 13, 14; CLI. 5; CLII. 2. **Suffolk**, XXI. 8, 12, 15, 16; XXII. 6, 7, 9, 10, 11, 14, 15; XXXII. 3, 4, 14; XXXIII. 1, 2, 4, 11, 15; XXXIV. 7, 8; XXXV. 7, 10, 15; XXXVI. 5, 13, 15; XXXVII. 5, 7, 9, 10, 11, 12, 13, 15, 16; XXXVIII. 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16; XXXIX. 5, 7, 9, 10, 11, 15; XLIX. 1, 2, 4; L. 1, 2, 3. **Warwickshire**, VIII. 16; XIII. 8, 16; XIV. 4; XV. 1; XVI. 13, 14; XVII. 15, 16; XVIII. 13; XIX. 6, 10, 11, 12, 14, 15; XX. 5, 14; XXIII 16; XLII. 15; XLIX. 5. **Worcestershire**, V. 16; VI. 4; X. 4, 8, 12, 16; XI. 6, 9, 10, 13, 14; XVI. 4, 8; XXXIV. 16; XXXV. 13, 14, 15; XL. 9; XLI. 4, 8, 12; XLII. 1, 2, 5, 6, 7, 9; XLIII. 5; XLVII. 3. *3s. each.*

England and Wales. **Geological Survey.**

District Memoirs.

South Wales Coal Field. Part v. The country around Merthyr Tydfil. 1*s.* 6*d.* (The region comprised in sheet 231.)

(*E. Stanford, London Agent.*)

Germany. **Königl. Preuss. Landes-Aufnahme**

Karte des Deutschen Reiches. Scale 1 : 100,000 or 1·6 stat. mile to an inch. Sheets: 315, Loburg; 316, Belzig. Herausgegeben von der Kartogr. Abtheilung der Kgl. Preuss. Landes-Aufnahme, 1904. *Price* 1.50 *mark each sheet.*

Naples. **Istituto Geografico Militare.**

Napoli e Diutorni. Scale 1 : 100,000 or 1·6 stat. mile to an inch. Istituto geografico militare, 1904. *Presented by Prof. Guido Cora.*

Vesuvius. **Istituto Geografico Militare.**

Cono Vesuviano. Scale 1 : 10,000 or 6·3 inches to 1 stat. mile. Levata nel 1900. Il Vesuvio. Scale 1 : 25,000 or 2·5 inches to 1 stat. mile. Levata nel 1900. Istituto geografico militare. *Presented by Prof. Guido Cora.*

The sheets of the large-scale Government Map of Italy, including the neighbourhood of Vesuvius.

ASIA.

Asia. **Service Géographique de l'Armée, Paris.**

Asie. Scale 1 : 1,000,000 or 15·8 stat. miles to an inch. Sheet 48 N. 132 E. Ningouta. Paris: Service Géographique de l'Armée, 1904.

Japan. **Japanese Imperial Geological Survey.**

Topographical Map of Japan. Scale 1 : 200,000 or 3·1 stat miles to an inch. Sheets: Sadowara, Shinjo, Toba. Tokyo: Imperial Geological Survey, 1904. *Presented by the Imperial Geological Survey of Japan.*

AFRICA.

Africa. **Intelligence Division, War Office.**

Africa. Scale 1 : 250,000 or 3·9 stat. miles to an inch. Egyptian Sudan. Sheets: 55-C, Geili; 55-D, Rera; 55-G, Wad Medani; (Provisional) 55-P, Middle Dinder; 66-C, Roseires. London: Intelligence Division, War Office, 1904. *Price* 1*s.* 6*d. each sheet. Presented by the Director of Military Operations.*

The region immediately to the east of Khartum is shown on these sheets, which form part of the important map of Africa now being compiled at the Intelligence Division of the War Office.

Egypt. **Survey Department, Cairo.**

Topographical map of Gharbia Province. Scale 1 : 10,000 or 6·3 inches to 1 stat. mile. Sheets: N.W. 36-1, 36-2, 36-3, 37-2, 37-4, 38-6, 39-1, 39-3, 39-5, 40-2. Cairo: Survey Department, Public Works Ministry, 1904. *Presented by the Director-General, Survey Department, Cairo.*

AMERICA.

Central America. **Sapper.**

Karte von West- Salvador und von Süd- und West Guatemala. Auf Grund eigener Aufnahmen 1889-1902, der Karten von Guatemala von Theodor Paschke 1889 und

Miles Rock 1895, sowie der Aufnahmen der interkontinentalen Eisenbahnkommission 1891–93, Corps 1. Entworfen von Karl Sapper, 1904. Scale 1 : 500,000 or 7·8 stat. miles to an inch. *Petermanns Geographische Mitteilungen*, Jahrgang 1904, Tafel 14. Gotha: Justus Perthes, 1904. *Presented by the Publisher.*

The height of the land is shown by colour tinting and contours at intervals varying from 100 metres to 500 metres. Altogether there are eleven tints; first, light green, showing land below 100 metres; next two light shades of sienna for land lying between 100 to 250 metres and 250 to 500 metres; and finally eight shades of darker brown, at 500 metres intervals, for heights from 500 to over 4000 metres. The result is decidedly effective, and the map is an important one, supplying fresh information concerning these imperfectly surveyed Central American States. The authorities upon which the map is based are stated in the title.

Salvador. **Sapper.**

Karte der Izalco Vulkane (Republik Salvador). Auf Grund eigener Aufnahmen aus den Jahren 1895, 1897 u. 1902, und der Originalkarten von Karl v. Seebach, und der interkontinentalen Eisenbahnkommission, entworfen von Karl Sapper. Scale 1 : 100,000 or 1·6 stat. miles to an inch. *Petermanns Geographische Mitteilungen*, Jahrgang 1904, Tafel 15. Gotha: Justus Perthes, 1904. *Presented by the Publisher.*

POLAR REGIONS.

Antarctic Regions. **Petermanns Geographische Mitteilungen.**

Entwicklung unserer Kenntnis der Länder südlich von Amerika, 1873–1903. *Petermanns Geographische Mitteilungen*, Jahrgang 1904, Tafel 16. Gotha: Justus Perthes, 1904. *Presented by the Publisher.*

GENERAL.

World. **Hartleben.**

A. Hartleben's Volks-Atlas enthaltend 72 Karten in Einhundert Kartenseiten. Vierte-Auflage. Lieferung 14. Vienna and Leipzig: A. Hartleben, [1904]. *Price 50pf. each part.*

Part 14 contains the following maps: No. 17, Europe, on the scale of 1 : 15,000,000; No. 55, France, 1 : 2,800,000; No. 75, Turkestan and Northern India, 1 : 10,000,000.

World. **Peip.**

Taschen-Atlas über alle Teile der Erde. In 36 Haupt- und 70 Nebenkarten von Chr. Peip. Mit geographisch-statistischen Notizen von Otto Weber. Stuttgart und Leipzig: Deutsche Verlags-Anstalt, 1904.

This is one of the many little German pocket atlases which have appeared in recent years, and includes thirty-six principal coloured maps and seventy plans and insets, preceded by statistical information and notes by Otto Weber. Altogether the atlas contains a great deal of information within the small compass of 4 inches by 6½ inches, but many of the maps are overcrowded and not clearly legible. Only one map of the British Isles is given, and that is a general map on a very small scale, upon which there are several mistakes in the place-names.

World. **Petrie and Schokalsky.**

Marck's Large General Table Atlas. Edited by Prof. E. J. Petrie and Colonel J. de Schokalsky. Part 8. St. Petersburg: A. F. Marks, 1904. [In Russian.] *Presented by the Publisher.*

The standard of excellence which characterized the first issues of this atlas is being well maintained, as will be seen by an inspection of the eighth part, which has just been published. The maps, which are four in number, are well drawn and clearly printed. They are as follows: No. 10, a chart of the world on Mercator's projection, showing colonial possessions, steamer routes, etc., with three inset plans; No. 28, a Black sea sheet of a map of European Russia on the scale of 1 : 2,000,000; No. 32, Belgium, Netherlands, and Luxemburg, 1 : 1,000,000; No. 56, Plans of the Pacific island groups on the scales of 1 : 9,000,000, 1 : 4,500,000, 1 : 2,250,000, and 1 : 1,125,000.

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published by the Hydrographic Department, Admiralty, during July and August, 1904. *Presented by the Hydrographic Department, Admiralty.*

No.	Inches.	
1683 m	= 14·7	England, west coast. Padstow harbour. 3*s*.
1919 m	= 9·9	Scotland. Hebrides, Lewis island:—Stornoway harbour. 1*s*. 6*d*.
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3435 m	= Var.	Sweden. Plans on the east coast:—The Narrows of Kalmar sound, entrance to Gefle, entrance to Umea. 1*s*. 6*d*.
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2285 m	= 2·8 1·8	Black sea. Varna:—Baljik bay. 1*s*. 6*d*.
3406 m	= 2·95	Newfoundland, east coast:—Bay of Exploits, Sheet I. (North). 2*s*. 6*d*.
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3431 m	= 0·82	Africa, west coast:—Cape Coast Castle to Barako point. 2*s*. 6*d*.
3432 m	= 0·82	Africa, west coast:—Barako point to Great Ningo. 2*s*. 6*d*.
3423 m	= 1·5 8·0	Africa, west coast:—Old Calabar river. Duke town anchorage. 2*s*. 6*d*.
3370 m	= 0·73	Philippine islands:—San Bernardino strait and approaches. 2*s*. 6*d*.
3429 m	= 4·7	China, east coast. Hong Kong island:—East Lamma channel. 2*s*. 6*d*.
3437 m	= 5·95	Japan. Nipon, west coast:—Hagi approaches. 1*s*. 6*d*.
431 m	= 4·65	Australia, west coast:—Swan river, North Fremantle to Perth. 2*s*. 6*d*.
1347		Peru. Plans on the coast. Plan added:—Huacho anchorage.
632		Africa, west coast. Walfisch bay to Orange river. Plan added:—Prince of Wales bay.
3311		Eastern archipelago. Anchorages on the north coast of Java. Plan added:—Tegal road.
1023		China, south coast. Boddam cove. Plan added:—Nam sha bay.
1256		China, north coast. Gulfs of Pe chili and Liau tung. Plan added:—Sketch of entrance and bar of the Yang kiao ko.

(*J. D. Potter, Agent.*)

Charts Cancelled.

No.		Cancelled by	No.
1683	Padstow harbour.	New plan. Padstow harbour	1683
1919	Stornoway harbour.	New plan. Stornoway harbour	1919
2842*b*	Baltic sea. Plan on this sheet. The Narrows of Kalmar sound	New plan. Narrows of Kalmar sound on sheet . .	3435
2377	Ports on the east coast of Sweden. Plan on this sheet:—Kalmar sound narrows.		
2285	Varna.	New plan. Varna. Baljik bay on sheet	2285
2287	Baljik bay.		
2395	Gulf of Magnok. Plan on this sheet.	New chart. San Benardino strait and approaches . .	3370

(*J. D. Potter, Agent.*)

Charts that have received Important Corrections.

No. 1188, The World:—Coal and telegraph chart. 34, England, south coast:—The Scilly isles. 1765, Ireland, south coast:—Queenstown and port of Cork (outer sheet). 1777, Ireland, south coast:—Queenstown and port of Cork (inner sheet). 3384, Ireland, south coast:—Queenstown. 2246, Baltic sea: Port Baltic to Hogland. 2694, France, west coast:—channels between Ile d'Ouessant and the mainland. 2554, Mediterranean sea, Italy:—Leghorn roadstead, etc. 2379, Black sea:—Kherson or Dniepr bay. 893, Newfoundland:—Burin harbour to Devil bay. 761, West India islands and Caribbean sea: Sheet I. 762, West India islands and Caribbean sea: Sheet II. 486, West Indies:—Jamaica, and the Pedro bank. 1274, Gulf of Mexico:—Tortugas cays to Cape San Blas. 23, Chile:—channels between Magellan strait and gulf of Trinidad. 631, South America, west coast:—Smyth channel from south entrance to Fortune bay. 2840, British Columbia:—Haro strait and Middle channel. 759A, Madagascar:—Cape St. Andrew to Bevato island. 821, Bay of Bengal:—Elephant point to Cheduba strait. 833, Bay of Bengal:—Rangoon river and approaches. 2153, Malacca strait:—Port Swettenham. 928, Sulu archipelago. 2577, Philippine islands:—Between St. Bernardino and Mindoro strait. 3283, Philippine islands:—Port Salomague and approach, Port Sual. 127, Japan:—Hirado no seto to Simonoseki strait. 1674, Australia, east coast:—Brisbane river. 2614, New Zealand:—Kaipara harbour. 2540, New Zealand:—Awarua or Bluff harbour and New river. 3044, Celebes:—Ujong Jonga to Ujong kassi.

(*J. D. Potter, Agent.*)

North Atlantic and Mediterranean. **Meteorological Office.**

Pilot Chart of the North Atlantic and Mediterranean for October, 1904. London: Meteorological Office. *Price 6d. Presented by the Meteorological Office, London.*

United States Charts. **United States Hydrographic Office.**

Pilot Chart of the North Atlantic Ocean for September, 1904, and of the North Atlantic Ocean and North Pacific Ocean for October, 1904. U.S. Hydrographic Office, Washington, D.C., 1904. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

Java. **Sternberg.**

Ninety-five photographs of Java, taken by F. Sternberg, Esq. *Presented by F. Sternberg, Esq.*

An interesting set of photographs illustrating the scenery, people, ancient rock-carvings, and monuments.

(1) Canal at Batavia; (2) Museum, Batavia; (3) "Gamelan," a musical instrument; (4 and 5) Masks used in Javanese dances; (6) Car of the steam tramway, Batavia to Weltevreden; (7) Javanese policemen; (8) Sado, Javanese conveyance; (9) Primitive way of watering streets at Batavia; (10) Men with powdered faces; (11 and 12) Women with powdered faces; (13) Old cannon at Batavia to which Javanese women make pilgrimages; (14) Live python; (15) Railway station, Buitenzorg; (16) Avenue in Botanical Gardens, Buitenzorg; (17) Inscription on tomb of Stamford Raffle's first wife, Buitenzorg; (18) Residence of Governor-General of Dutch East Indies; (19-21) Views in Botanical Gardens, Buitenzorg; (22) A group of Javanese in Buitenzorg; (23) Klong Tong, Chinese hawker and coolie; (24) House and palms; (25) The morning bath; (26) Javanese house, Buitenzorg; (27) Guard house and Tong Tong; (28 and 29) Chinamen, Buitenzorg; (30) Hat seller, Buitenzorg; (31) Prisoners getting sand from river; (32) Typical group, Buitenzorg; (33) Palm-wine seller, Buitenzorg; (34) Javanese dancing-girls; (35) Luncheon party, Buitenzorg; (36) Javanese open-air restaurant; (37) Javanese refreshment hawker; (38) Picturesque bridge; (39 and 40) River scenes at Surabaya; (41) Chinese bazaar, Surabaya (42); Chinese pawnshop, Surabaya; (43) Clock Tower erected by British residents to commemorate Queen Victoria's Jubilee, Surabaya; (44) Javanese sailing-craft; (45) Trikar or bullock-cart, Surabaya; (46) Residential street, Surabaya; (47) A group, Surabaya; (48) *En route* for the mountains; (49) *En route* to Tosari; (50) A mountain inn; (51) Road to Tosari; (52) Village of Ledok; (53) Javanese boy carrying Mr. Sternberg's camera; (54) Group at Tosari; (55) Waiting for the wedding procession; (56) The bride; (57) Open-air shop, Tosari; (58) Batok mountain; (59) Sand sea and wall of Bromo; (60) View looking down the active Bromo crater; (61) Our party at the Bromo; (62) Monkeys at Blau Water; (63) *En route* for the Boro Boedor ruins; (64) A market on the way; (65) Boro Boedor; (66) Entrance to the Boro Boedor; (67) A gallery at the Boro Boedor; (68–70) Sculpture on Boro Boedor temple; (71) Ruins of Hundred Temples; (72) Figure and Mr. Sternberg at entrance to Hundred Temples; (73 and 74) Bambranan Temple; (75-79) Carvings on Bambranan Temple; (80) Inn at Iokjakarta; (81) Curious trees in front of Kraton, Iokjakarta; (82) Women carrying loads; (83) Javanese country policemen; (84) A primitive yet effective sunshade; (85) Water Kastell, Iokjakarta; (86) Entrance to Water Kastell; (87) Sultan's bath Water Kastell; (88) Railway station, Garoet; (89) Square and Mosque, Garoet; (90) Stickseller with big hat; (91) Village of Bagendit; (92) Raft on lake at Bagendit; (93) Women fishing in lake at Bagendit; (94) On the road to Tjipanas; (95) Tjipanas.

Persia. **Sykes.**

Two hundred and eighty-two photographs of Eastern Persia, taken by H. R. Sykes, Esq., M.A. *Presented by H. R. Sykes, Esq., M.A.*

Upon his return to Persia in 1902, Major Sykes, the well-known British consul at Kerman, was accompanied by his cousin, Mr. H. R. Sykes, who has since had good opportunities of visiting some of the little-known districts of the eastern part of the country. He has taken a most interesting set of photographs, copies of which have now been presented by him to the Society. The titles are as follows:—

(1) View of Bandar Abbas from sea, Kuh-i-Ginao beyond; (2) Major Sykes' camp at Kush-Kuh and Kuh-i-Shamil beyond; (3) Major Sykes' camp in the Navargu pass; (4) Natives and huts in the Navargu pass; (5) Natives at Rahdar cutting up dead camel; (6) Ramparts of fort (ruined) at Rudkhana-i-Duzdi; (7) Interior of above fort; (8) Natives and huts in Jiruft valley; (9) Gipsy women in Jiruft; (10) Musicians in Jiruft singing to the accompaniment of drums; (11) Women of Jiruft, weaving jowal; (12) Major and Mrs. Sykes at foot of Ushteran pass, escort of Sikhs of Central Indian Horse; (13) Mounting the Ushteran pass; (14) A caravanserai at Khanch Khatun; (15) On the Bam plain, looking south towards the Jubal Bariz range; (16) Nearing Pa-kenneh from the Gudar-i-Deh-Bekri, the Jumal Bariz range in distance; (17) Tehrud fort, exterior view, north-east; (18) Tehrud fort, interior view, west; (19) Tehrud fort, east, looking north-west; (20) Mill at Sabistan; (21) Hot spring at Abarik, view east; (22) House lent me during my stay at Bam; (23) Takht-i-Ravan; (24) Vali Khan and retinue at Bam fort; (25) The outskirts of Rain; (26) View from summit of Bam fort, looking north; (27) Kuh-i-Hazar from the approach to the Hanaka pass; (28) View from summit of Bam fort, looking south, ruined town in foreground, Jumal Bariz range in distance; (29) Rigan from the fort; (30) View from camping-ground at Dahan-i-Abbas Ali; (31) Members of the Palangi tribe in cave at Dahan-i-Abbas Ali; (32) On the way to the Gishan pass; (33) On the way to the Gishan pass, 2½ miles from Dahan-i-Abbas Ali; (34) View south-west from the top of Gishan pass; (35) Half-mile below summit of Gishan pass, looking east; (36) View of Mil-i-Farhad at 2 miles, looking west; (37) Mil-i-Farhad and Panj Angusht mountains, looking north-east; (38) Shakerabad natives weaving jowal; (39) Yar Amad Khan and suite at Shakerabad; (40) Palm groves and cultivation at Jaghin; (41) Manujan fort, view north-west; (42) Manujan fort, view south; (43) View from Manujan fort, looking north-west towards Kala Kahnu; (44) Mirza Khan and suite at Manujan fort; (45) Plain near the Manujan river, 3 miles from Manujan; (46) Jaghin river and palms; (47) Natives and huts, Jaghin; (48) Kala Kahnu, village and fort; (49) Jaghin: loading up the mules; (50) On the road between Jaghin and Barinti; (51) Confluence of the Rudkhanch-i-Duzdi and the Manujan river, a mile below Barinti; (52 and 53) Looking down the valley of the Minab river; (54) My escort from Jaghin; (55) My caravan crossing the Minab river; (56) Rock cliff in Minab river 15 miles from Barinti; (57) Weathered clay formation in Minab river; (58) Minab fort, built on a conglomerate cliff; (59) Minab; (60) Kuh-i-Shamil from near Kalabi; (61) Palm-grove and Kuh-i-Shamil; (62) Natives reaping near Kush Kuh; (63) Native musicians at Kush Kuh; (64) In the Tang-i-Zindan, where the caravan route leaves the main river-bed; (65) In the Tang-i-Zindan, near the entrance; (65) View in the Tang-i-Zindan; (67) View from the summit of Kotal, looking back over the Tang-i-Zindan; (68) Natives at Sar-i-Sikh, men; (69) Ditto, women and children; (70) Sar-i-Sikh, early morning; (71) Natives at Pur; (72) Our camp at Pur, looking east; (73) The summit of the Gudar-i-Kafanu; (74) The Lalazar range from near the summit of the Kafanu pass; (75) View of Lalazar range from near Bezinjan; (76) Watch-tower between the Kafanu and Zarchu pass; (77) Nagar and the Kuh-i-Chehel-Tan; (78 and 79) Nestorian church at Nagar; (80) The tower of the Nestorian church, Nagar; (81) On the Nagar plain, looking south-west towards Nagar; (82) C.M.S. hospital, Kerman: the dispensary; (83) Kerman walls and moat on east side of city; (84) The Masjid gate, Kerman; (85) Kerman: mosque near the Masjid gate; (86 and 87) Kerman: shops in the city; (88) Kerman: mosque without the walls; (89 and 90) Kerman: a caravanserai; (91) Kerman: gate leading from the Maidan into the ark; (92) Kerman: the Negah Khaneh; (93) Kerman: Nurulla Khan's unfurnished house; (94) Kerman: general view from the walls, with Jupar range in distance; (95) Kerman: butcher's shop; (96 and 97) Kerman: the ice-houses; (98) Kerman: woman washing clothes in a kanat; (99) Kerman: the Parsi anjuman; (100) Mohammed Hadi, merchant of Kerman; (101) Kerman: entrance to the British consulate; (102) The Naraujistan garden, Kerman; (103) The consulate, Kerman: Mr. H. R. C. Dobbs starting for Sistan; (104) Soghuk and Kuh-i-Bidkhan; (105) Soghuk; (106) View of houses at Soghuk; (107) Buchakchi tribesmen, rifle-shooting; (108) Chiefs Buchakchi tribe; (109) Head waters of the

Halil Rud above Gugher; (110) Village of Gugher from camp, looking west; (111) Natives and huts, Gugher; (112) The fort at Hushun; (113) Camp at Chaharain; (114) The Kej-ma-Kej pass, 11,500 feet; (115) A "Chaman" in the Lalazar range; (116) The Lalazar range and my camp near Kej-ma-Kej looking north-east; (117) Lalazar range from the top of the watershed looking over Rahbur; (118–120) In the Lalazar range; (121) Woodman in Lalazar range; (122) Nest of the *Lagomys rufescens;* (123) *Ovis ourialis*, July 4, 1903; (124) A school in Rahbur; (125) Rahbur: oxen carrying kah; (126) Threshing corn at Rahbur; (127) Hut at Shirinak where I slept on my way from Rahbur to Mahun; (128) Camp at Robat; (129) Roof of caravanserai, Robat; (130) Caravanserai at Kabuter Khan, showing telegraph material; (131) Camp at Bayaz; (132) Persian and English wires; (133) Caravanserai and pool, Gird Kuh; (134) Gird Kuh, mountain and village; (135) A street in Faraj (Yezd); (136) The village square, Faraj; (137) C.M.S. hospital, Yezd; (138) Interior of one of the wards, C.M.S. hospital, Yezd; (139) Yezd: Dr. White's house and garden; (140) Yezd: view from a roof looking south-west; (141) A Parsi gardener; (142) Outside Yezd, showing the Kuh-Shir; (143) Yezd, looking north-east; (144) The "Pusht-i-Bag" gate, Yezd; (145) Old walls at Yezd; (146) Meidan-i-Shah, Yezd; (147) The ark and moat, Yezd; (148) Yezd: the Meidan Khan; (149 and 150) Meidan-i-Mir Chak-mak, Yezd; (151) Caravanserai, Anjirak, looking east; (152) Anjirak tower; (153) Kharuneh, the west side of village; (154) Kharuneh, the south side of village; (155) Kharuneh, village and aqueduct; (156) Kharuneh, looking north-north-east; (157) Kharuneh, looking north; (158) Kharuneh, and country looking north-east; (159) Kharuneh: the aquaduct; (160) Kharuneh: the Husseiniah; (161) A street, Kharuneh; (162) Kharuneh: view from the middle of village looking south-east; (163) A street, Kharuneh; (164) Rocks near Kharuneh; (165) Ab-ambar between Kharuneh and Rizab; (166) Caravanserai at Rizab; (167) Village of Robat-i-Khan; (168) Hills near Robat-i-Khan; (169) Caravanserai at Dam-i-Dahneh; (170) Camp at Deh Mohammed and Kuh-i-Stilakh; (171) Deh Mohammed, old fort; (172) Espak; (173) Caravanserai Espak; (174) Neigenu: the fort and moat; (175) Neigenu gateway in the old walls; (176) Bridge in salt desert, near Neigenu; (177) The shora, or salt desert; (178) In a caravanserai, Kasimabad; (179) Baluch tents at Marandiz; (180) Houses in Marandiz; (181) Fort at Marandiz; (182) Baluch family, Marandiz; (183) Bridge at Yunsi; (184) Old gate in the walls at Faizabad; (185) Village at the southern foot of the Bidar pass; (186) Village of Kala-i-Kafir; (187) Caravanserai at Sherifabad; (188 and 189) A shop at Sherifabad; (190) Camel-boy, native of Yezd; (191) The new road between Sherifabad and Meshed; (192 and 193) British consulate, Meshed; (194) The British consulate garden, Meshed; (195 and 196) View of the Shrine Meshed from the roof of the Imperial Bank; (197) View of the shrine, showing the Khyaban-i-Païn; (198) The Khyaban-i-Païn; (199 and 200) In the Khyaban-i-Païn, Meshed; (201) Ziarat, stone pinnacles built by the pilgrims on approaching Meshed; (202) The Band-i-Feraiman, the inside view; (203) The Band-i-Feraiman, from the outside; (204) Mill near the Band-i-Feraiman, showing icicles; (205) Heratis on their way to Meshed; (206) Turbat-i-Sheik Jam; the gate of the fort; (207) The shrine at Turbat-i-Sheik Jam; (208) Abambar at Turbat-i-Sheik Jam; (209) The aiwan shrine, Turbat-i-Sheik Jam; (210) The main street, Turbat-i-Sheik Jam; (211) Fakir at Turbat-i-Sheik Jam; (212) Bizg; (213) Door of the fort at Bizg; (214) The Kala Sang at Ustai, looking north; (215) Hoaz on top of Kala Sang; (216) Remains of hoazes, on top of Kala Sang; (217) Ruined madresseh near Rui Khaf; (218) Interior of Madresseh; (219) Tile-work, interior of madresseh; (220) Roof of a room in the madresseh; (221) Natives of Sangan; (222) Natives of Bamrud; (223) Village of Bamrud; (224) Range at Bamrud; (225) Village of Afin; (226) Village of Zehun; (227) Birjund: Abbas Ali Khan, the Karguzar, Abbas Ali Khan's brother-in-law; (228) Prisoners at Birjund; (229–231) View from the old fort; (232) A street in Birjund; (233) The main street, Birjund; (234) A shop in Birjund; (235) A street corner in Birjund; (236) The hatting industry, Birjund; (237) Fort Birjund; (238) House of the governor in Birjund; (239) Mod, where I spent Christmas Day, 1903; (240) Captain Winter's camp at Gorit; (241) Stores and horses, Captain Winter's camp at Gorit; (242) A village wedding, dancing; (243) Chahar Farsaki villagers; (244) Kuh-i-Shah Duzd from near Neh; (245–247) Ruins on Kuh-i-Shah Duzd; (248) The Perso-Afghan Boundary Commission: camp at Gul Chah; (249) Gul-chah; (250) Colonel McMahon's escort; (251) Sistan village: Deh Haji Khamber; (252) Weaving calico in a Sistan village; (253) Village of Taj Mohamed; (254) The Takht-i-Pul, showing one arch; (255) General view of the Takht-i-Pul; (256) Sistanis at Kuh Kul Shah; (257) Sistanis ploughing; (258) Goldsmid's boundary, Persian territory; (259) Duck-shooting on tutins; (260) Hamun, showing puzeh 180 feet high; (261) View of Hamun from puzeh; (262 and 263) The old bed of the Helmund boundary of Afghanistan by Goldsmid; (264) The south wall, Nasratabad; (265) The main gateway, Nasratabad; (266) The main street, Nasratabad; (267) Windmills at Husseinabad; (268) Colonel McMahon's mission camels dying of influenza; (269) Mr. G. Tate surveying; (270) Kuh Kuh Shah: ruins and modern village; (271) The Akhunzadas escort of Afghan infantry; (272) Baluch levies at the Gymkhana; (273) Colonel McMahon, the Akhundzada on left, Yamin-i-Nizam on right; (274) Asad Ulla Khan at Naibid caravanserai; (275) The top of the Zainalabad pass, 8200 feet, looking north; (276) Zainalabad caravanserai, looking north-east; (277) Mahun, prince's garden in March; (278) Mahun: shrine with Jupar range beyond; (279) Mahun, shrine in the main court; (280) Geological example near Mashiz; (281) Caravanserai of Sinj-i-Tu; (282) Cave used as a caravanserai near Saadetabad.

South Africa. **Sandbach.**

Forty-eight panoramic views of South Africa, taken by Captain William Sandbach in 1901 and 1902. *Presented by Captain William Sandbach.*

A set of panoramic views taken by Captain Sandbach during the Boer war. They measure 11⅛ inches by 3⅛ inches, and, apart from their illustrating incidents during the campaign, they are of geographical interest, inasmuch as they serve well to show the character of the country.

(1–25) Views around and about Krawz Kop or Ntunjambili in the Umvoti country, Natal, between Hopetown and Middle Drift on the Tugela river; (26 and 27) Camp at Rockdale, 6 miles south-east of Middelburg; (28–30) Scheipad, Steelpoort valley; (31–33) Paardekloof; (34 and 35) Indabe, to warn Jiaffta, local chief, that peace had been made; (36 and 37) View near Roos Senekal, rocky and thorny bush country; (38) View looking towards Roos Senekal from the north; (39) View looking towards Roos Senekal from the west; (40) Recovery of Krupp howitzer hidden by Boers in the clump of willows; (41) View near Roos Senekal; (42) Camp at Pan, Delagoa bay line between Middelburg and Machadodorp; (43 and 44) View showing ordinary veldt and road, and waggons of a column on the march; (45) Machadodorp; (46) Cape Town from the steamer; (47 and 48) Las Palmas.

Vegetation Types. **Karsten and Schenck.**

Vegetationsbilder, herausgegeben von Dr. G. Karsten und Dr. H. Schenck. Zweite Reihe, Heft 2. Die Mangrove-Vegetation. Von G. Karsten. Jena: Gustav Fischer, 1904. *Price 4 marks.*

The photographs from which the twelve plates in this part have been taken, have been well selected to illustrate mangroves and mangrove swamps, and they convey a good general idea of this remarkable type of vegetation. Prof. G. Karsten, of the Bonn University, who took most of the photographs, furnishes the explanatory text.

Victoria Falls. **Melvill.**

Eleven photographs of the Victoria Falls, Zambezi river, taken by E. H. V. Melvill, Esq. *Presented by E. H. V. Melvill, Esq.*

These very fine bromide enlargements are probably the best photographs of the Victoria Falls hitherto taken. They exhibit the remarkable structural features very clearly, and are generally most instructive and interesting. The mist effect is well shown.

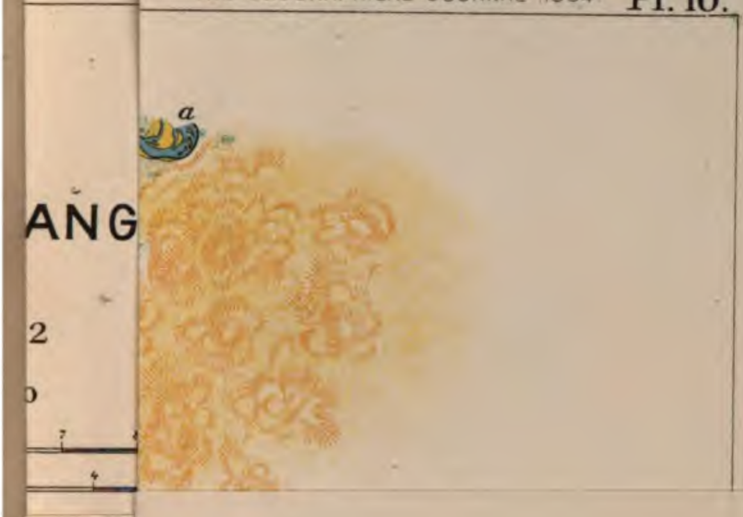
(1) First zigzag below Victoria falls and site of railway bridge; (2) Second and third zigzag, Victoria falls; (3) East end, Victoria falls; (4) Zambezi river above Victoria falls; (5) The Devil's cataract and west end of Victoria falls; (6 and 7) The Devil's cataract, Victoria falls; (8) Above Devil's cataract; (9) Rain forest; (10) Palm grove; (11) Baobab tree, 69 feet in circumference.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

FROM LAJLIK TO JANGI-KÖL.

DR SVEN HEDIN.

THE GEOGRAPHICAL JOURNAL 1904. **Pl. 10.**



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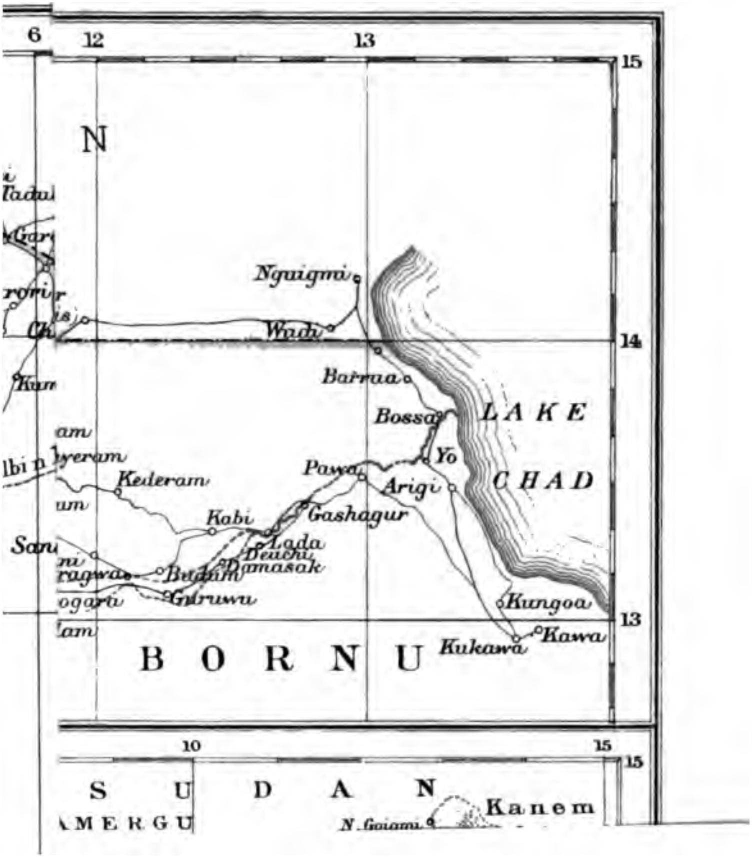
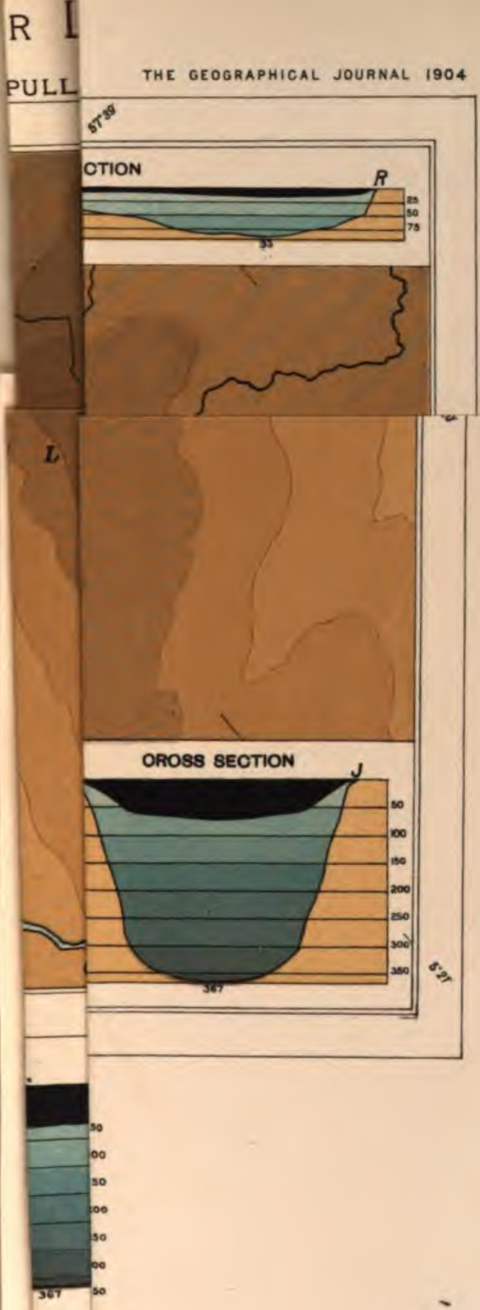
THE GEOGRAPHICAL JOURNAL 1904.



THE GEOGRAPHICAL JOURNAL 1904



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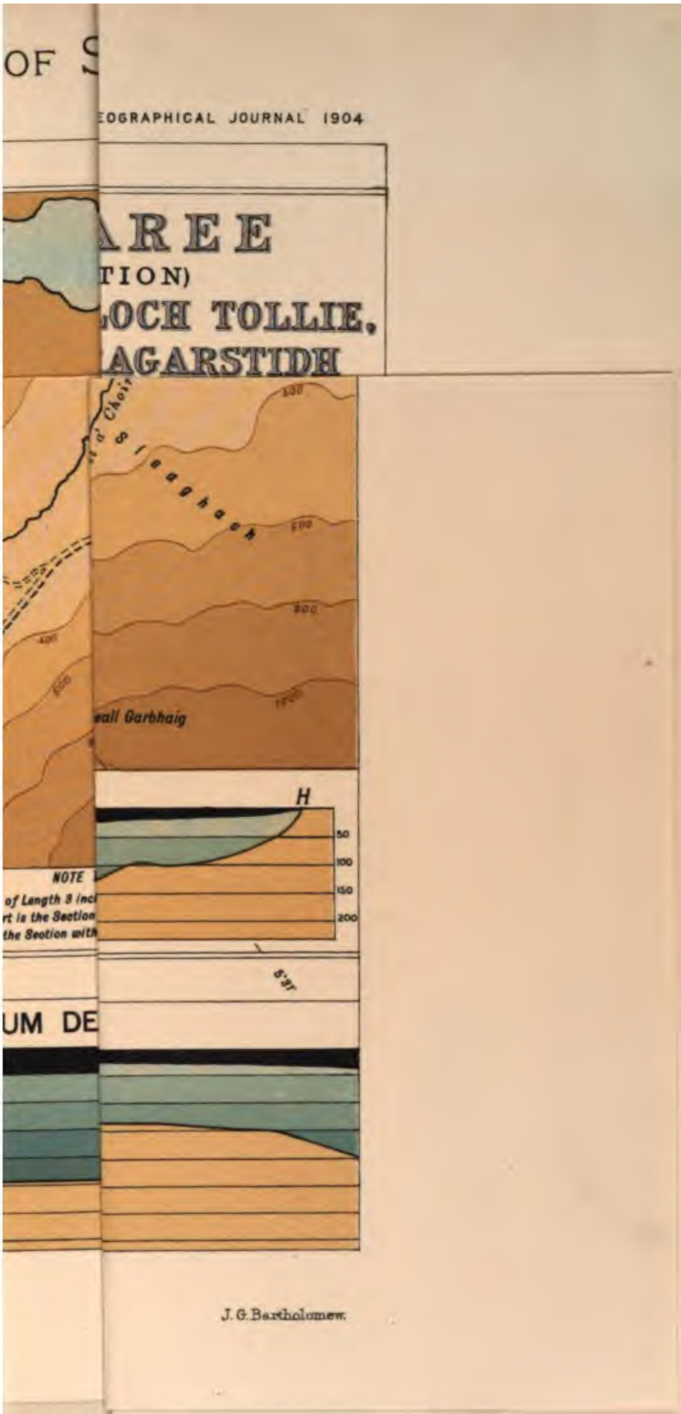
J. G. Bartholomew



J. G. Bartholomew.

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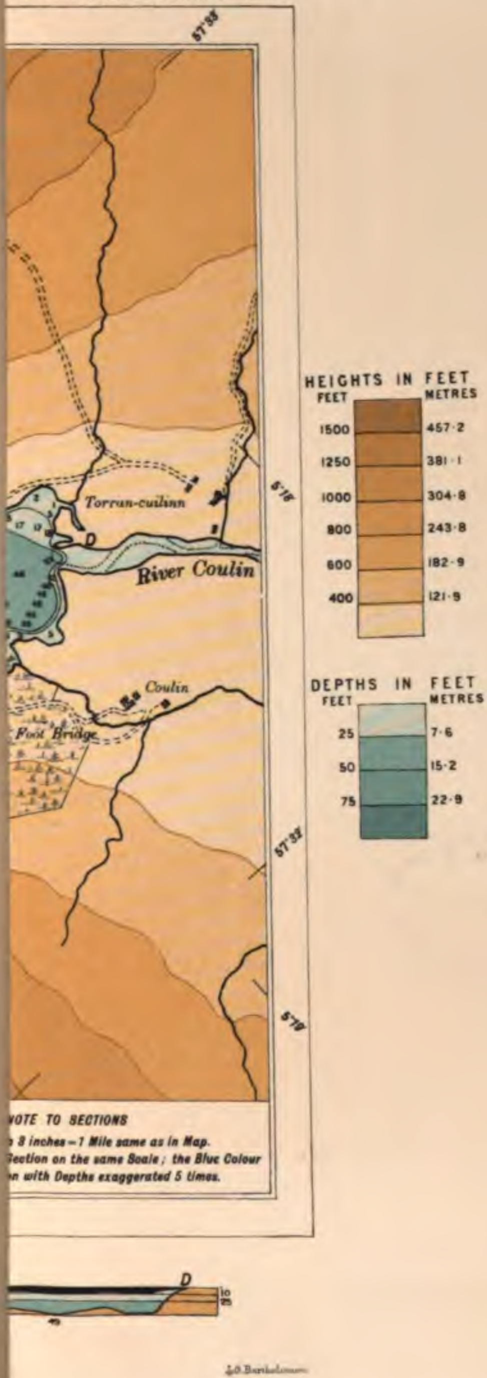
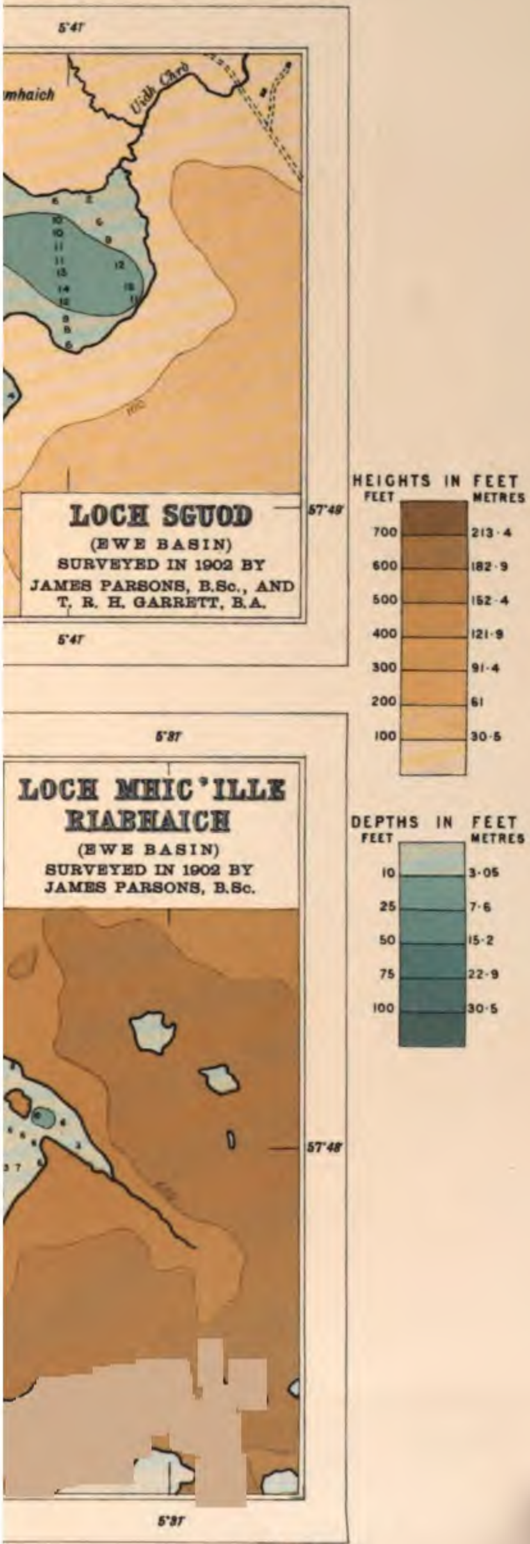


NOTE TO SECTIONS
 8 inches – 1 Mile same as in Map.
Section on the same Scale ; the Blue Colour
n with Depths exaggerated 5 times.

J.G. Bartholomew.



LOCH SGUOD
(EWE BASIN)
SURVEYED IN 1902 BY
JAMES PARSONS, B.Sc., AND
T. R. H. GARRETT, B.A.

LOCH MHIC'ILLE RIABHAICH
(EWE BASIN)
SURVEYED IN 1902 BY
JAMES PARSONS, B.Sc.

J.G.Bartholomew.

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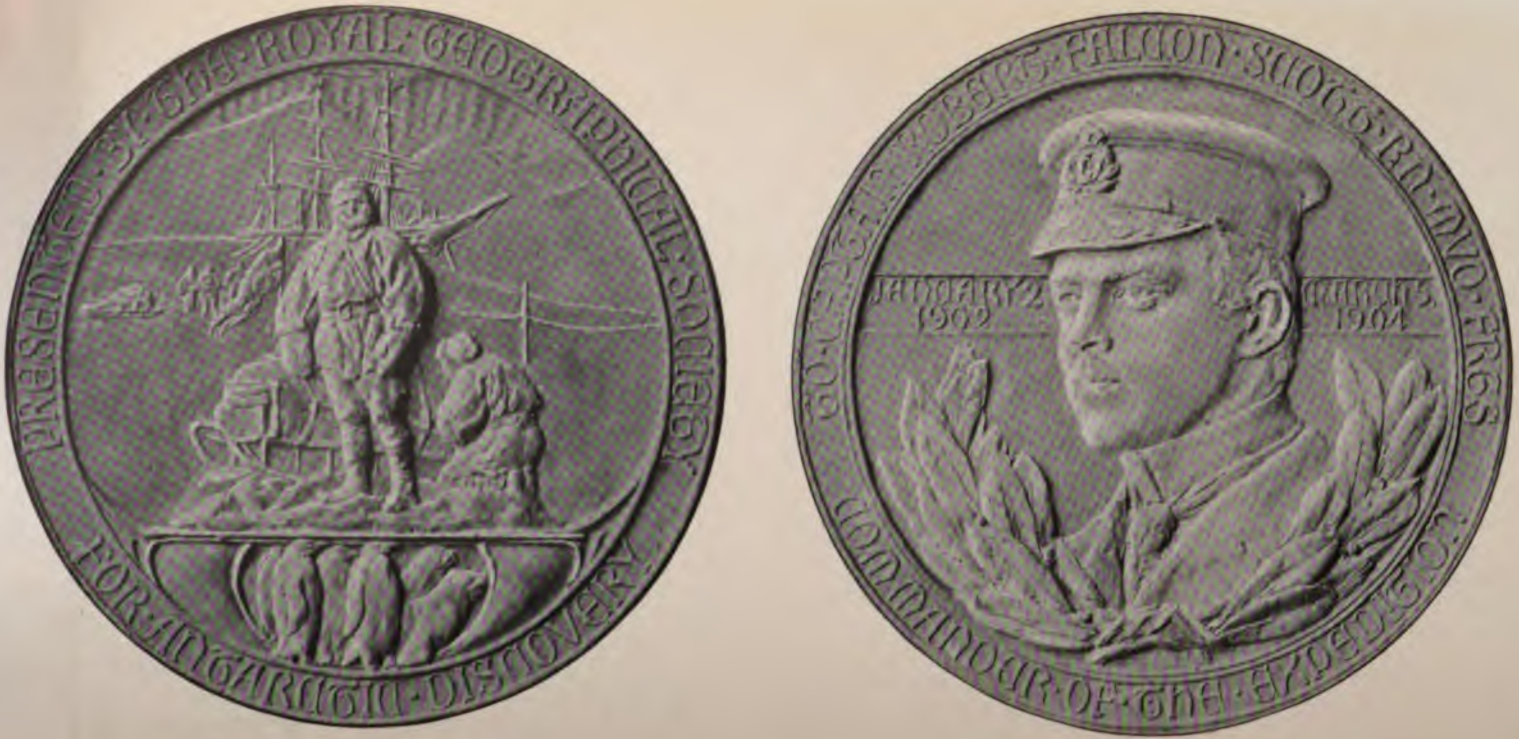
PRESENTED·BY·THE·ROYAL·GEOGRAPHICAL·SOCIETY
FOR·ANTARCTIC·DISCOVERY
FALCON·SCOTT·RN·MVO·FRGS
COMMANDER·OF·THE·EXPEDITION
JANUARY 2 1902
1904

Special Antarctic Medal presented by the Royal Geographical Society to Captain R. F. Scott, C.V.O., R.N., in Gold, and to the Officers and Men of the "Discovery" in Silver, November, 1904.

The
Geographical Journal.

No. 6. DECEMBER, 1904. Vol. XXIV.

THE ANTARCTIC MEETING AT THE ALBERT HALL.

Presentation of Medals to Captain Scott.

On Monday, November 7, a large and distinguished assembly gathered in the Albert Hall to welcome Captain Scott on his return from the Antarctic Regions, and hear from him the account of the brilliant exploits performed by himself and his comrades during their long sojourn in those regions. The chair was taken by Sir Clements Markham, who was supported, among others, by the American Ambassador. The platform was occupied by the Council of the Society and many distinguished travellers and explorers, as well as by the officers and crew of the *Discovery* and the officers of the *Morning*. The audience, which numbered some seven thousand, included a large number of Fellows of the Society and their friends, with other visitors. Captain Scott's narrative was listened to with close attention and keen interest, and the applause with which it was punctuated showed the appreciation by the hearers of the determination and daring shown by the gallant explorers in their fight with the adverse conditions of the Far South. Many were the hairbreadth escapes of which Captain Scott had to tell, the most thrilling incident being no doubt that which occurred during the leader's return from his sledge expedition over the great inland ice-plateau of Victoria Land, when, with one of his two companions, he fell into an unnoticed crevasse in the glacier, and was only saved by the tackle attaching him to the sledge which the third member of the party just managed to hold back from following them into the yawning ice-chasm. The address was illustrated throughout by a remarkable series of lantern-slides, about 150 in all, which gave a vivid idea of the wild and desolate character of the icy southern regions, and of the animal life by which alone the desolation is relieved.

They also helped the audience to realize the conditions of life to which the explorer is subject who attempts to unveil the mysteries of this, the last *terra incognita* on the Earth's surface.

It is unnecessary here to publish in full the substance of Captain Scott's address, as the main outlines have already been put before the readers of the *Journal* in the reports printed in the numbers for July, 1903, and July, 1904, the latter being illustrated by a map, of which copies were distributed to the audience. A further outline of the scientific results of the expedition will also, it is hoped, be put before the Society at one of the evening meetings during the present session.

In introducing Captain Scott to the audience, the PRESIDENT said: We are assembled in this vast hall to welcome home Captain Scott and the officers and men of the *Discovery* on their return from their arduous and difficult services. Look at those flags on the right and on the left of the organ—which is now covered by a sheet—those are the sledge-flags with which our countrymen bore the cross of St. George to the utmost corners of the Earth, where foot of man had never trod before. Captain Scott will now tell us the story of that great work, and it is my privilege to introduce to this vast assembly our distinguished explorer.

After the address, which lasted about an hour and a half, and was heard with great clearness to the furthest end of the vast building, the PRESIDENT said: The meeting will, I am sure, desire me to convey its very cordial thanks to Captain Scott for his interesting address. The Council of our Society are deeply impressed by the admirable way in which Captain Scott has conducted the expedition, by the zeal and ability shown by the officers and the scientific staff, and by the splendid work and constant loyalty of the men. We have decided to strike a special Antarctic Medal in gold for Captain Scott, and one in silver for each of the officers and men. It is now my pleasure to present Captain Scott, in the name of the Royal Geographical Society, with our special Antarctic Medal.

I introduce to you His Excellency the American Ambassador, who will also say a few words.

The Hon. JOSEPH CHOATE: The magnificent tribute which the audience paid to Captain Scott to-night, in recognition of the hardships and perils that he has encountered, and the great achievements that he has won, could hardly be complete, I think, without a single word of sympathy from the other side of the Atlantic. It is true that my countrymen are at this moment engaged in a great affair of their own which absorbs the attention of every man, woman, and child in the Republic, but yet they have room in their hearts for a word of greeting to your distinguished explorer. It is true, also, that they have had no hand or part in this great Antarctic Expedition, but for years and generations, nevertheless, they have been interested in polar exploration.

The Government and the people alike have been interested in it, and if you will only let Captain Scott continue his great work and complete the map of the world by planting the Union Jack upon the south pole, and let our Peary proceed with his disciplined followers and plant the Stars and Stripes upon the north pole, why then you will make the two ends of this great world meet, and leave the globe that we inhabit as it properly should be—in the warm and fraternal embrace of the Anglo-Saxon race. I will not take up your time to do more than mention the names of some of our own Arctic explorers, and that for a special purpose. You have all heard of Dr. Kane, and Dr. Hayes, and Lieut. De Long, and Captain Hall, and Greely, and last, but not least, Peary. All of those who survive their perilous undertakings, and return to the bosom of their country, receive cordial recognition from this side of the water, and all, except Captain Hall and Lieut. De Long, who sacrificed their lives in the Arctic Regions, received the medal of the Royal Geographical Society, in recognition of their services to mankind. Now, in recognition of that fact, and the interest of themselves and the Society and of the great people they represent in this advance of knowledge, this progress of mankind, this constant growth of science, which is represented by the work of men like Captain Scott, the Philadelphia Geographical Society has authorized me to present on its behalf to Captain Scott this Gold Medal for the year 1904. It bears on one side the medallion of Dr. Elisha Kent Kane, their old discoverer, in whose honour, I believe, their Society was organized, and on the reverse there is this inscription: "For eminent Geographical Research—Philadelphia Geographical Society—Incorporated, 1903—Awarded to Captain Robert F. Scott in the year 1904," to whom I have the very great privilege of presenting it in their name to-night.

Captain Scott: I hope that you will allow me to reply to the great honour in a very few words. Speaking for myself and my companions, we have had an extraordinary experience in more ways than one. The majority of us are naval officers, and we have been in the habit of serving under naval discipline. On this occasion we have served, not under naval discipline, but with the same laws as if we had been under naval discipline, and we have served two great Societies. I may say sir, that it has been our pleasure to know that our interests and everything to do with them have been looked after in the same way as if we had been serving in His Majesty's fleet. Sir, I know we have to thank you and the Council and officers of the Royal Geographical Society for this. I cannot say how much I appreciate this great award. It seems a great deal more, when I look back on others who have had special medals, it seems a great deal more, certainly than I deserve. Perhaps there is one thing that makes polar exploration a more interesting task than the greater number of those tasks in which you serve your country—

it is that the results do not only interest your own countrymen, but they interest the inhabitants of other countries. A practical example of that has been shown by His Excellency, and it seems as though I am rather overcome by it raining medals to-night. But I am bound to confess that there is no quarter from which such rain could more happily come than from His Excellency.

The PRESIDENT: Captain Scott has described to you the joy he and his companions felt on the arrival of the *Morning*. It was a necessity that the Expedition should be annually visited. We therefore bought the stout old ship the *Morning*, and we gave the command to Captain Colbeck. Captain Colbeck has done his work admirably. He has shown great organizing power, he has shown seaman-like qualities, he has shown ability, and, above all, he has shown firmness. We also desire to thank the officers of his ship who so nobly and so admirably seconded his efforts, and we thank the men of the *Morning* for their excellent conduct, which has done honour to the mercantile marine. For these things the Council of our Society was desirous of showing what it felt on the return of the *Morning* from her two voyages. The Council has therefore resolved to present a testimonial to Captain Colbeck in the form of this piece of plate, which is intended in all its parts to illustrate the voyage and to illustrate the Antarctic Region. The handle represents Scott island, which was discovered by Captain Colbeck. The globe, which is intended for a punch-bowl, represents the voyage, and it is supported by three kinds of Antarctic seals. The following verses are engraved round the handle and round the equator—

"Joy cometh in the Morning."
"We bring you in the Morning bread to the full."

I now have great pleasure in presenting Captain Colbeck with our testimonial.

Captain COLBECK: I really do not know how to thank you for this reception, and you, Sir Clements Markham, for the kind way in which you have shown your appreciation of the work done by the *Morning*. We have all felt it a great honour to be associated with Captain Scott in the *Discovery*, and to work with him, and I am sure what little we did has given us more pleasure than he will ever believe. This has been my first voyage under naval officers, and I am proud to have had this experience. My respect for the navy increased as my knowledge of Captain Scott and his crew increased. Thank you for the confidence you have always shown in us of the *Morning*; it has always assisted us. We always felt we were being supported the whole time. Sir, I thank you.

The proceedings then terminated.

ENGLAND AND WALES VIEWED GEOGRAPHICALLY.*

By HUGH ROBERT MILL, D.Sc.

It is the causal idea in geography which makes the science rich and full of human interest, and the object of the present article is to indicate, in a particular case, the broad lines along which this idea works, and to give such concrete instances as may help the reader to follow them farther and apply them more completely. In treating England and Wales from the purely geographical standpoint, the aim is thus not to state facts which may be new to the reader, but rather to supply a framework in which the familiar facts fit naturally, and by their placing throw light upon each other and the whole.

Geologists have pointed out that the nature and arrangement of the rocks determine the way in which climatic conditions act upon and shape the land into hill and valley or plain. But this is only the beginning of a vast and complicated system of mutually interacting agencies. The land-forms, produced originally by climatic influences, affect in their turn the incidence of wind and rain so as to give rise to local climates of great interest and importance. Climate and land-surface together affect the distribution of vegetation and the nature of plant associations, and this distribution also reacts upon both the climate and the land-surface. All these influences bear upon the distribution of animals, and play their part in deciding the places of human settlement and the lines of human movement, and finally human energy reacts upon every element of the complex geographical environment, and that more effectively than any of the unconscious activities of nature.

The form and elevation of the land-surface are the most important geographical conditions at any particular epoch of time. Although they are constantly changing on account of the action of all the forms of activity which they direct by offering unequal resistance, the process is so slow that, except in a few instances, it is of no importance within the range of human history. Viewed in relation to the vistas of geological time, the hills may be fleeting shadows and the coasts changing forms, but geographically, save for the small exceptions referred to, the hills are eternal and the coasts are boundaries that cannot be passed. The permanence of physical configuration in relation to human history is a fact that should never be lost sight of. It constitutes one of the clearest lines of division separating the fields of geography and geology.

The fundamental conditions of vertical relief and coast-development in England and Wales are shown with beautiful clearness in the map, where they appear alone, on a somewhat small scale it is true, but unobscured by artificial boundary lines or the names of towns or counties.

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* To accompany a map embodying the nomenclature of the physical features of England and Wales. Map, p. 708. This map was prepared by Mr. J. G. Bartholomew,

Strictly speaking, the large island of Great Britain should be described as a single unit, yet it is surprising how distinct the northern and southern portions are, physically as well as historically; and there is no violence done to fact by treating England and Wales by themselves. The coasts are more uniform in outline, less indented, and far less deeply fringed by off-lying islands than those of Scotland; but, as in the northern kingdom, the east coast is simpler and less indented than the west.

From the mouth of the Tweed on the extreme north in lat. 55° 48′ to Lizard Head on the extreme south in 49° 58′, there is a range of nearly six degrees in latitude; and from Lowestoft in long. 1° 56′ E. to Land's End in 5° 43′ W., there is a range of 7½ degrees in longitude, corresponding to a difference of half an hour in time. If the extreme points of the coast were joined by straight lines to form a figure resembling a triangle, but open at the top, the eastern side would measure 348 miles, the southern 316 miles, and the western 354 miles. When, however, allowance is made for the indentations of the actual outline, the east coast is found to measure 640 miles, the south coast 545 miles, and the west coast as much as 1225 miles. If the smallest possible length of coast-line be represented in each case by 1, the actual length of the east coast would appear as 1·8, of the south coast 1·7, and of the west coast no less than 3·5; in other words, the west coast is twice as much indented as the east or south.

The indentations of the coast are sufficiently large and numerous to secure that no point in the whole of England and Wales is more than 75 miles from the sea. The most inland part of the country is a narrow strip stretching from Buckingham to near Birmingham. The narrowness of the southern part of the North Sea and of the eastern end of the English Channel enable the great land mass of the neighbouring continent to influence the climate of a considerable part of the south-east of England, thus extending the area of typically inland country.

The three coasts of England appear even more dissimilar when considered in relation to the land behind them and the sea in front. The unindented east coast borders the Eastern Plain for the whole distance

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and the nomenclature upon it originated in a discussion at a meeting of the Research Department of the Royal Geographical Society upon a paper by Dr. H. R. Mill. A sub-committee of the Research Committee, consisting of Mr. G. G. Chisholm, Mr. H. J. Mackinder, and Dr. H. R. Mill, was appointed to suggest a nomenclature for the larger features of the relief of England and Wales, especially for such features as were without definite names for their whole extent. This Committee proposed a series of names, endeavouring to introduce none which were not in harmony with the general character of English place-names. The proposals were discussed in the Research Committee, and remitted to the Council of the Royal Geographical Society, by which, after further discussion and some modification, they were approved. Although the nomenclature proposed by the Committee and approved by the Society is adopted, the article cannot claim to express more than the individual views of the author.

between the chalk promontories of Flamborough Head and the South Foreland. It is broken by the large and shallow estuaries of the Humber, the Wash, and the Thames. The estuary of the Thames opening opposite the mouths of the Rhine, in a sense made London; but the town has grown to such importance that to the sailor the whole estuary is known as London River, and technically the Port of London includes all the waterways and docks between London Bridge and the Nore. Both the Thames and the Humber early became, and have always continued to be, great centres of maritime trade with the Continent; but the Wash is too shallow for modern ships, and except for Harwich—a ferry-port to the Continent—none of the smaller estuaries or coast towns are more than fishing ports or pleasure resorts. North of Flamborough Head the coast is steeper and higher, the estuaries, though small and narrow, lead into regions of mineral wealth, so that they could be profitably deepened to admit the largest vessels for the export of coal and manufactures of iron and chemicals. Thus the Tees has given rise to the iron-exporting and ship-building ports of Middlesbrough and Hartlepool; the Wear gives access to the great steel-ship building town of Sunderland; and the narrow estuary of the inky Tyne has become one long seaport for sending out coal, chemicals, and ships and munitions of war from Shields at the mouth to Newcastle at the head of navigation.

The North Sea stretches as a shallow and often a very stormy sheet of water towards the Continent. Depths exceeding 30 fathoms do not occur south of the latitude of Flamborough Head, and the deepest water between any part of the east coast of England and the opposite shore of the Continent reaches 50 fathoms only in one small patch. The floor of the North Sea rises in the centre to a large plateau known as the Dogger Bank, on which the depth varies from 20 to less than 10 fathoms. South of the Dogger, the sea-bed is curiously ridged and furrowed by long banks and "pits" running nearly parallel to the coast, each of which has been discovered and sounded out by the fishermen who have from time immemorial reaped the ever-ripe harvest of the flat-fish of the North Sea. The soles and plaice bred in the shallow water of the Eastern Grounds bordering the continental shore migrate as they approach maturity towards the central and western banks, so that large-sized fish were probably always more numerous off the coast of England than near the Dutch and German ports. In their time one or another of the pits or banks became famous for the abundance or the quality of its fish, and in the days of line-fishing and of trawling smacks, the fishing villages adjacent to these grounds became places of local importance. The introduction of steam trawlers and of steam fish-carriers changed the relation of the east coast fishing grounds and fishing villages. The chief concern being to bring the fish quickly to the market, the trade has become concentrated to a remarkable extent in the Thames, where the steam carriers, coming direct from the fishing fleets at sea, run right up to Billingsgate Market, and at Grimsby, at the Humber mouth, where good dock accommodation and an excellent railway service bring the trawlers of the Northern Grounds into communication with all parts of the country. Hull, Yarmouth, and Lowestoft also derive benefit from the North Sea fisheries, and owe much of their importance to that cause.

Where the North Sea meets an arm of the Atlantic in the Strait of Dover, the narrowing of the dividing sea gives rise to the passenger traffic with the Continent which has been the making of Dover and Folkestone. The strategic as well as the commercial importance of Dover, commanding as it does the two seas, has justified the enormous expense of constructing a great naval and commercial harbour on one of the most unpromising sites along the whole coast, and has given rise to keen controversy as to the political wisdom of sanctioning attempts to build a bridge or bore a tunnel to overcome the insularity of Britain and give access by rail to foreign countries.

The south coast faces a deeper sea than does the east, but one less adapted for fishing by means of the trawl; and, except in the case of the mackerel, pilchard, and herring fishery of the west, little development has resulted from that industry. The shelter afforded by the Isle of Wight to the channels of Spithead and the Solent, and the depth of Southampton Water, running inland to within two hours by rail of London, have given immense and growing importance to the centre of the south coast. The commercial harbour of Southampton, the port for passenger embarkation to South Africa and by several lines to America, finds its naval counterpart in Portsmouth. The narrowing of the English Channel between the Isle of Wight and Portland Bill on the north, and the peninsula of Brittany on the south, gives occasion to the most westerly line of cross-channel traffic from Weymouth and Southampton to France and the Channel Islands.

The western extremity of the south coast partakes of the general character of the west. Deep inlets running far into the land form magnificent natural harbours, in the finest of which—Plymouth Sound—lie the naval dockyards of Devonport. Here the development of a large trade in the transfer of passengers and mails carried by ocean liners depends only on the ability of the railways to give rapid communication with the great centres of population, and an improved train service has brought Plymouth almost as near London in point of time as Liverpool is.

The west coast opens upon the Atlantic obliquely through St. George's Channel, and for the most part it faces the turbulent Irish sea, the depths of which are similar to those of the English Channel, and greater than those of the North Sea. The edge of the continental shelf with soundings of 100 fathoms runs from Ushant to off the west of Ireland, at right angles to the English and the Bristol Channels, so that vessels even in a fog can find soundings and know their position long before there is any danger of running ashore. No other gateway of maritime commerce is so efficiently guarded by Nature against risk of shipwreck. Two important inlets, the large and wide Bristol Channel and the narrow Mersey estuary, run far into the land, one to the south and one to the north of the bold projection of Wales. The Bristol Channel, originally of value as an ocean highway leading to Bristol, has now greater importance from the ready outlet it affords to the coal-shipping ports of Cardiff, Barry, Swansea, and Newport along its northern shore. The Mersey is the chief entrance for American and West African trade to the densely peopled northern industrial area, most of the goods being landed or loaded in the docks of Liverpool and Birkenhead. It is the entrance, also, for the growing traffic by direct steamers through the ship-canal to Manchester.

The block of Wales separating south-western from north-western England runs out into two promontories separated by the wide sweep of Cardigan Bay. The southern promontory is cleft by Milford Haven, a harbour which has lost the advantage of its fine geographical position from the sea on account of its unfortunate geographical position from the land, lying as it does remote from the great centres. The northern promontory is the low island of Anglesey, where Holyhead, being almost in the straight line from London to Dublin, is naturally the chief port for communication with Ireland. Northward of the Mersey the sandy plain of Lancashire fronts a low shore, where a few small ports struggle against great natural difficulties. Barrow, one of the most purely artificial seaports in the country, draws its prosperity from the iron and coal deposits of the margin of the Lake District. The west coast of England terminates in the sandy shallows and treacherous tides of the Solway, an inlet of the sea resembling the Wash in its economic inutility.

The surface of England stands in close relationship to the nature of the underlying rocks, and the influence of the broad geological divisions can be traced through all the geographical distributions. Looked at as a whole, South Britain is divisible into three parts. The **Western Division** comprises three masses of uplands, all composed of ancient rocks much penetrated by old volcanic outbursts, and each attaining a maximum elevation exceeding 2000 feet above the sea. The Northern mass includes the Cheviots, the Lake District, and the Pennine Chain; the Western consists of Wales and the bordering hill ranges; and the Southern occupies the peninsula of Devon and Cornwall. The **Eastern Division** corresponds with the region of the Jurassic, Cretaceous, and more recent rocks. Few points within it attain an elevation so great as 1000 feet, and the hills which ridge its surface are for the most part escarpments, steep on one side and gently sloping on the other. The hard ancient rocks, with their treasure of the Coal Measures and their volcanic dykes and bosses, are buried far beneath the surface. Between the two divisions the third stretches as a transition zone popularly known in its central part as The Midlands, but that name was not adopted for the map. On the south and east this corresponds with the plain of Lias clay, on the north and west with the plain of the Triassic red rocks separating the groups of the Western Division.

The rivers of England and Wales necessarily radiate from the elevated masses of land and flow across the bordering plains to the sea; but it is worthy of remark that, with the solitary exception of the Humber, no streams rising in the Western Division cross the Eastern Division on their way to the sea.

The climate of England and Wales is influenced to a considerable extent by the configuration of the land. If the land were flat and of uniform level the only factors affecting climate would be the heat received from the sun, which would diminish uniformly from south to north, and the prevailing wind, which would blow on the whole from some point between south-west and west-south-west. The result would be that in summer, when the sun is powerful, temperature would be highest in the south and lowest in the north; and in winter, when the sun is feeble, temperature would be highest in the west where the warm air from the Atlantic exercises its full influence, and lowest in the east. The temperature would, in addition, be more extreme—hotter in summer and colder in winter—than the latitude warrants in the centre of England on account of its distance from the sea, and in the south-east on account of its proximity to the Continent. The rainfall would be nearly uniform over the whole surface of the country, although in the region of more extreme temperature it would be less on the whole, while the falls in thunderstorms would be greater.

In reality the climate varies greatly from point to point, the conditions stated above being modified in the most intricate and interesting way by the configuration of the ground. The temperature of the air falls off, as the height above sea-level increases, at the rate of 1° Fahr. for each 300 feet, so that places on the high moorlands rising to 1500 feet or more are permanently, and at all seasons, at least 5° colder than places in the same latitude at sea-level. Where the land slopes towards the south, the rays of the sun fall more nearly perpendicularly on the surface, and their heating power is consequently greater; while where the land slopes towards the north, the rays fall more obliquely, and the heating power is less than on level ground; hence local climates of very different character exist in places which are in the same latitude and have the same height above the sea. The wind, though it usually blows from some westerly or southerly point and is relatively warm, frequently comes from northerly or easterly directions and is cold; and it necessarily happens that places on the east coast, or on the eastern side of high masses of land, are more exposed to harsh and inclement weather than those on the western slopes. Where a range of hills or a line of cliffs protects a favoured spot from north and east and leaves it open to south and west, the warmest climate possible to our islands is produced, though it may be in a very small area, such, for example, as the sea-margin at Bournemouth and Torquay. It is to this cause rather than to their position in latitude that the mildness of the seaside towns of the south coast is due; while the sharp bracing climate of the Yorkshire coast and moors is in its turn the result of exposure to easterly and northerly winds rather than of latitude.

The effect of configuration upon climate is most marked in the case of rainfall. Moisture-laden wind may blow over a level expanse of country and produce little precipitation, but when it encounters a slope and is forced to rise into the cooler regions of the upper air condensation increases rapidly, and to a considerable extent the rainfall of the land increases with its altitude. The effect is, however, probably due to slope as well as to height, a steep hill causing the air to ascend for some time after the summit is passed, and so producing the maximum fall of rain a little distance beyond the summit on the leeward side. On account of this relationship, and because of the shelter afforded by a mass of high land to a plain to leeward, the rainfall map of England and Wales, while it corresponds very closely to the map of vertical relief, resembles a blurred impression. The famous centre of high rainfall at The Stye and Seathwaite in the Lake District, and the scarcely less wet valleys on the east of Snowdon, owe their character for intense wetness to this fact. The highest average rainfall occurs in the mountains of Wales, the Lake District, the Cheviots, and the Pennine Chain; and to a less marked degree on the high moors of Cornwall and Devon, and along the lines of the Cotteswold and Chiltern Hills, the Chalk Downs, and the Wolds of Lincoln and York. A narrow zone of low rainfall borders the coast on the west as well as on the east, and whenever a plain stretches inland, it forms a region of low rainfall. Even a comparatively narrow valley running up amongst hills maintains a lower rainfall along its floor than prevails on the bordering heights. Shelter also plays its part, and all causes conspire to make the driest region of England the inland portion of the low Eastern Plain which extends from the Humber to the Thames. The great dry area of England stretches westward to the Severn valley, and it is surprising to find how low a mean annual rainfall prevails close under the Welsh mountains, which drain the sea wind of its moisture. It sometimes appears that the rainfall begins to diminish with altitude after a certain height above sea-level is past; but it is more likely that the exposed position of the rain gauges on high hill-sides causes increased loss of rain on account of eddies set up by the wind about the gauge.

Vegetation is perhaps even more sensitive to variations of temperature and rainfall than to changes of soil, though in this connection it must be noticed that a stiff clay subsoil, as in the Fenland, may retard the drainage of low flat land to such a degree as to counteract the effects of a low rainfall and produce a humid climate nourishing a marshy vegetation. The profitable cultivation of all farm crops ceases at a comparatively low elevation, and above 1500 feet, alike in the south and in the north, the vegetation is reduced to the plant-associations typical of moorlands—heather, fern, and mosses; trees have disappeared, and except when the moor is drained and cultivated, grass does not predominate. When the land rises to 2500 feet or over, the surface is usually of bare stones, scantily starred by a few stunted plants growing in the slight shelter between them.

Since cultivation is possible in the lower grounds only, it follows that the higher regions of the country are practically without population except where mineral resources are abundant and valuable. The highest land, though of little use even for sheep pasture, is essential to the life of the large towns of the valleys penetrating the high moorlands, and even to those of the more distant plains, for the collection of the rainfall in reservoirs for water-supply. So great is the demand for water in large towns, that there is now scarcely an uninhabited moor or upland in the whole Pennine chain which has not been set apart for water-supply, and in most cases efforts are made to remove all possible causes of pollution by keeping the ground free from crops or live stock.

The elevation and configuration in the Eastern Division exercise no direct influence on population, as no part rises above the limits of pasture, and very little is above the zone of profitable cultivation. An indirect influence is, however, produced by the geological formation, for the hills are permeable masses of chalk, limestone, or sandstone upon which no surface water is available, while the plains are covered with stiff clay, through which the water-bearing rocks may be reached at no great depth. Hence in the Eastern Division also the hill ridges, though often traversed for long distances by high-roads, are devoid of population, which throngs densely on the low ground. The Lincoln Edge, the Chiltern Hills, and in an even more interesting way the Weald, supply excellent illustrations of this fact.

Speaking broadly, and of course excepting seaports, the geological rather than the hypsographical map explains the distribution of population in England and Wales. Wherever mineral wealth or easily reached underground water is found, there are towns or close chains of villages; where neither is to be had, there are strips of country, even within 50 miles of London, which are totally uninhabited. It must be noted, however, that when it is possible to sink deep wells, or when it becomes profitable to pump a supply of water from a distance, as in the parts of the North Downs nearest London, modern residences have sprung up in large numbers, an accessible water-supply having been the one thing lacking for a dense population.

The Western Division.—The Cheviots form the most northerly mass of high land in England; the northern part, indeed, belongs to the Southern Uplands of Scotland. The Cheviots are grassy hills furnishing excellent pasturage for sheep, and giving rise to numerous rivers which flow to the North Sea, a number of south-flowing tributaries uniting in the Tyne, the narrow valley of which is joined by the Tyne Gap to a valley draining to the Solway, and the two completely isolate the Cheviots from the Pennine Chain. Through this gap runs the direct railway between Carlisle and Newcastle, and along its northern slope the Romans built their great wall against the Caledonians.

The Pennine Chain runs southward from the Tyne Gap as a broad moorland, loftiest on the western side, where it rises in summits of nearly 3000 feet, and sending rivers towards the east through long dales, the home of the sparse pastoral population of former days. In the Crossfell section the Lower Carboniferous rocks of the high moorlands give place upon the eastern flanks to the Coal Measures, and the lower valleys are the site of a dense coal-mining and iron-manufacturing population, the outlet for whose industry is through the seaports of the Tyne, Wear, and Tees. Crossfell itself is the culminating summit of the remarkably steep and straight escarpment which bounds the Eden Valley and faces the gentler heights of the Lake District, forming the nearest approach to the appearance of a mountain range in England.

The Whernside section of the Northern Pennines extends as a more broken and broader mountainous group from the valley of the Greta, a tributary of the Tees, to the Aire Gap, where the valleys of the Aire and the Ribble nearly meet. On the west it closely adjoins the Lake District; on the east its long dales widen as they descend between spurs of moorland to the broad Vale of York. Health and pleasure resorts, such as Harrogate and Ilkley, have arisen to take advantage of the fine air of the moors, the climate being in some instances the most valuable of the natural advantages.

Southward from the Aire Gap the Pennine Chain contracts in breadth, and the Southern Pennines, after rising to 2088 feet in the wild limestone plateau of Kinderscout in the High Peak District, subsides southwards in a series of radiating spurs separated by the romantic river valleys of Derbyshire. This section of the Pennine Chain is the most remarkable of the three. The Coal Measures crop out both on the eastern and the western slopes, giving to both sides of the country the character of mining and manufacturing districts. Chains of towns of every size run through the lower valleys. Some of these are mere aggregates of mean houses, sheltering miners and factory hands, stretched for dreary miles along the wind-swept upland valleys; others are great cities on the plain. Manchester and Oldham, with their satellite towns, stretch almost to Liverpool over the Cheshire Plain on the west

Leeds, Bradford, and Sheffield cling closer to the hills on the east, and form, with other woollen-weaving towns of the West Riding, a zone of seething urban life between the desolate uplands west of them and the quiet agricultural Vale of York to the east. Almost every valley in this section has its railway, and several are traversed by canals. The lofty ridge separating Lancashire from Yorkshire is surmounted by chains of locks on the canals, crossed at the passes by several railways, and pierced by others in tunnels several miles in length. It is one of the most striking instances in the geography of the British Isles of a natural barrier of a somewhat formidable kind overcome at the command of trade necessity. Sheep are still pastured on the slope of the moors, though practically all the wool employed in the manufactures is now imported. In some of the remoter valleys semi-domestic industries, especially paper-making on a small scale, still linger, the motive-power being supplied by water; but the coal-mines now determine the sites of all important manufacturing towns.

As in most regions of pronounced configuration, the boundaries of political divisions in the Pennine Chain follow natural features. The watershed running from north to south forms, with scarcely an exception, the county boundaries between Cumberland, Westmorland, and Lancashire on the one side, and Northumberland, Durham, and Yorkshire on the other. The boundary between Durham and Yorkshire is marked throughout by the river Tees; though usually the dales forming the valleys of the rivers are natural units, in which the old spirit of the clannish pride and perhaps the local jealousy of dalesmen of former days may sometimes still be traced.

The Lake District is a remarkable mountainous region separated from the Pennine Chain by Shap Fell and the divergent rivers Eden and Lune. It is scored radially by a series of valleys of remarkable beauty, most of them containing one or two long narrow lakes of considerable depth. Here practically all the natural lakes of England are comprised within a circle of 15 miles radius. The region rejoices in an excessive rainfall, due to its abrupt ascent in the track of the prevailing sea wind, and it is of little economic value save in the coastal plain, where there are coal mines and seaports. Its few inhabitants depend for their livelihood mainly on the tourists attracted by the beauty of its scenery and on the well-to-do residents to whom its literary associations make it a congenial home. The whole district is full of charm, for the beauty of a dry day in a land of rain amply repays the patience with which it may sometimes be awaited.

Two other small hill-groups, not unlike miniature Lake Districts devoid of lakes, separate themselves westward from the Pennine Chain and spread out into the Cheshire Plain. These have no comprehensive names sanctioned by local custom, but they may be called after the ancient forests of Bowland and of Rossendale.

They are now clusters of barren hills separated by valleys—the Bowland Forest group only silent pasture, the Rossendale crowded with small towns of factory workers and miners, with the great centres of Bolton, Bury, and Rochdale on the south, and Blackburn and Burnley on the north. Both groups are diversified by artificial sheets of water in the reservoirs, some of which rival natural lakes in size.

The peninsula of Cornwall and Devon has a distinct individuality amongst the natural regions of England. Its separation from the Eastern Division is accentuated by the small plains of Somerset and of the Exe, to the west of which rise the typical moorland masses of Exmoor on the north and Dartmoor on the south, separated by the Plain of Devon. These moors are desolate and dreary in the extreme, the last haunt of the wild red deer, and no more hopeless hold for prisoners of war could well be imagined than the huge building on Dartmoor, erected during the Napoleonic struggle and now the most forbidding convict prison in the country. The heights in Cornwall are less pronounced, but Bodmin Moor is a fitting companion to the moors of Devon, and the precipitous cliffs of the coast, veined with ores of copper and tin, afford an indication of the resources which made Cornwall a place of importance for centuries, and at one time, now many years ago, a leading centre of original scientific work.

Wales acquires its semi-independent position as an integral part of South Britain from historical considerations; but these are direct consequences of its position and configuration. Physically the Welsh Highlands include the hills of Shropshire, Hereford, and Gloucester west of the Severn, as well as the county of Monmouth, which is grouped for all practical purposes, and especially for statistics, along with Wales, though actually part of England. Although the Shropshire hills are of no great height, they are picturesque and prominent features, and stand in close agreement with the geological structure. The Malvern Hills rise in the Vale of Severn much as Charnwood Forest rises above the plain of the red rocks in the north of the Midlands.

The loftiest and most picturesque of the Welsh mountains are those of the north-west, which rise in two distinct divisions. Of these the Snowdonian group culminates at 3560 feet in Snowdon, the loftiest mountain south of the Scottish Highlands. Its flanks are trenched by valleys, in many of which small lakes or tarns still remain. The whole group of Snowdonia has a very high rainfall on account of the abruptness with which the mountain slopes rise from the level of the sea, fronting the wet west wind. This, with the centre of the Lake District and a portion of the North-Western Highlands of Scotland, can claim the distinction of being one of the few spots in Europe with a mean annual rainfall exceeding 100 inches. The industry of the district lies mainly in the great slate quarries; but the coast is lined by health resorts, of which Llandudno, by reason of its sheltered situation and mild, dry climate, is the chief. To the south and east, beyond the valley of the Dee, which contains Bala Lake, the largest natural body of fresh water in Wales, the Berwyn Mountains form another belt of high ground running nearly at right angles to the trend of Snowdonia. While the steep north-western face of the mountain group drains through the Dee to the Mersey, the gentler south-eastern slopes discharge the copious rainfall through long valleys to the Severn. In one of these a great reservoir—Lake Vyrnwy, as large as Coniston Water—has been constructed for the supply of water to Liverpool. The great reservoir has a special geographical interest, for it has been formed by reconstituting an ancient lake-bed, and so restoring a feature of pre-glacial topography. This section of North Wales is for the most part uninhabited except for villages in the valleys, and the larger part of the population continue to speak no language but Welsh, so great is the isolation of the district from external intercourse.

Mid-Wales, between the valleys of the Severn and the Wye, is a rough plateau rising on the east and still higher on the west above the level of the centre. The eastern elevations culminate in Radnor Forest, the western form a nearly continuous chain, the Mynydd Bach, running at first south and then south-westward from Plynlimon. On the eastern flanks of this ridge new reservoirs for the supply of water to Birmingham have created two large and picturesque lakes in the valley of the Elan, a tributary of the Wye, one of which is as large as Bala Lake, the other inferior only to Windermere amongst the lakes of South Britain. This western ridge is not crossed by a railway for nearly 60 miles, and it has formed an almost complete barrier to communication between east and west.

The South Wales uplands are separated from those of the north by the Vale of Brecon, through which the Usk flows south-eastward. They culminate in the Brecon Beacons, the slopes leading up to which from the south are deeply scored by parallel valleys of southward drainage cutting through the Coal Measures, and consequently the scene of enormous activity in coal-mining and iron-smelting. All the principal valleys, and many steep and difficult gorges, are traversed by railways linking the mines and blast-furnaces with Swansea, Cardiff, Barry, and Newport, the ports of shipment on the coast of the Plain of Gwent. This region acquires imperial importance from its mines of anthracite, the smokeless coal which is peculiarly adapted for the furnaces of warships. The dense populations of the narrow valleys are still so recent that they have hardly given rise to any towns; even Merthyr Tydvil is in plan and appearance scarcely more than an overgrown village, though it houses over 100,000 inhabitants. Barry Dock was excavated in 1888 amongst the sand-dunes on a desolate piece of coast, in order tc afford a new outlet from the coal-fields of the high valleys to the sea, and within a few years it ranked as one of the great seaports of the world.

The compact group of the Black Mountain between the Usk and the Wye is a wild and desolate district, though on the margin of the fruitful plain of Hereford.

The Midlands.—The plain which surrounds the southern extremity of the Pennine Chain, separating it from the Midlands on the south, and from Wales on the south-west, is deepened into the Vale of Trent trending east and north, and the Cheshire Plain trending west and north. South of these slight depressions the Midlands rise to an undulating plain some hundreds of feet above sea-level. For the most part this district is formed of the Triassic red rocks, through which coal may be reached in many places, and so there have arisen, not only the great commercial centre of Manchester, but also the vast industrial aggregations of population in the Potteries about Stoke and Hanley, and in the Black Country to the north and west of Birmingham. The development of the mineral wealth of the Black Country has a somewhat remarkable history, for when the old ironworks deserted the forests of southern and eastern England on pit-coal taking the place of charcoal in smelting, coal-pits were at hand to supply the ironworks near Birmingham, which formerly drew their supplies of charcoal from the Forest of Arden. The Midlands are diversified by hills of ancient rock rising like islands through the newer strata of the plain. Of these the most remarkable are Charnwood Forest to the north-east and the Wrekin to the north-west. The Vale of Severn separates this region on the west from Wales, and forms a region peculiarly favoured by soil and climate, for it combines the warmth of the west with the dryness of the east.

The Eastern Division.—The physical character of the Eastern Division can be understood best when the geological map is superimposed upon that of configuration.

The predominant features are the long lines of low hills of limestone or chalk rising with a steep face on one side, usually the north or west, above a plain of clay, and sinking with a gentle slope to the opposite side, usually the south or east, beneath a plain of clay similar to the first, so far as appearance is concerned, but of more recent origin geologically.

The line of limestone hills, forming the Oolitic escarpment of the geologists, commences with the Cotteswolds, which, attaining a maximum height of 1000 feet, run with a curved front along the eastern margin of the Vale of Severn, and the southern margin of the Vale of Evesham. The hills are tunnelled by several lines of railway on their way from London to the west of England, and crossed by one line of the Great Western, as well as a canal, winding through the Gap of Stroud. The pasturage on these hills supplied wool in old days for a spinning and weaving trade, which still survives in the production of West of England cloth. The line of the Cotteswolds is continued in Edge Hill, and further to the north in the less pronounced ridges of Northamptonshire; but even where the escarpment fades into the low Lincoln Edge or a mere cliff along the right bank of the Trent, it remains a distinct feature in the landscape. Beyond the Humber the limestone hills reappear, bounding the Vale of York, on the east, and rising in the North York moors and the Cleveland Hills to just over 1000 feet. In the Cleveland Hills overlooking the estuary of the Tees valuable ores of iron occur, and have been the determining cause of the great iron industry which gave rise to Middlesbrough. The plain of Lias clay at the base of the Oolitic escarpment forms the rich agricultural belt of the Midlands, with Leicester as its most important town, and the beautiful sylvan scenery of the "Dukeries," perhaps the most typically English landscape in the country. The number of ancient towns, of no great size, but with historic names which belong to this belt of country, is worthy of note, and points to a time when the conditions determining the distribution and growth of centres of population were totally different from those now in force. The quiet old cathedral cities and market towns flourished in full activity when the Church had a monopoly of learning and the farmer a monopoly of trade, and they naturally failed to expand with the growth of manufactures carried on by means of mechanical power.

The northern line of Chalk hills rises in turn over a rich agricultural plain of clay, under which the gentle slopes of the Limestone hills dip, and forms a series of bare and rounded heights without inhabitants, and valuable only for pasture. They run through Dorset as the Western and the Purbeck Downs, form the northern edge of Salisbury Plain, and then the short chain of the White Horse Downs leading to the central portion known as the Chiltern Hills, which sink north-eastward into the East Anglian Ridge, reappear again beyond the Wash in the Lincoln Wolds, and beyond the Humber in the Yorkshire Wolds, which end grandly in the white chalk cliff of Flamborough Head. On the clays and water-bearing Greensands at the base of the Chalk escarpment there is almost everywhere a line of villages and small towns where the scanty population of purely pastoral and agricultural parishes is concentrated. The continuity of the Chalk hills is more geological than geographical; at their highest they are completely cut through by rivers, as in the Thames Gap below Oxford, which draws a natural line between the Upper Thames Basin, formed by converging valleys on the long slope of the Cotteswolds, and the Lower Thames Valley, which lies on the London Clay. Towards the east the Chilterns sink to a mere ridge on the great Eastern Plain, which sweeps through the east of England from the estuary of the Thames to the Vale of York.

The Eastern Plain is lowest in its central portion around the shallow Wash, where it forms the almost Dutch district of the Fenland, a sort of saucer of clay filled with a nearly level sheet of silt and peat. Some of it is below mean tide level. Much of it has been artificially drained and embanked, and wherever a bed of gravel or some portion of the underlying rocks penetrates the surface and rises more than 25 feet above the sea, it forms the site of an ancient town clustered picturesquely round a still more ancient church. Ely with its cathedral is the finest type of a purely Fenland city.

The lower Thames valley occupies a hollow in the Chalk filled with clay and gravel, and its low level and gentle slope allows the tidal influence to extend a very long distance from the sea. Here at the head of ocean navigation, the vast conglomerate of municipalities known collectively as London has arisen and is steadily extending on every side, in complete disregard of natural conditions, for proximity to London makes a marsh or a steep hillside equally worth reclamation or terracing into building sites. The geological formation secures a vast natural water-supply in the saturated Chalk lying below the impermeable layers of clay. Artesian wells bored through the clay tap this supply, which is derived from the ring of Chalk hills surrounding London at a distance still beyond the suburban area; but year by year the wells have to be deepened to keep pace with the ever-sinking level of saturation. Thus it has come about that every natural condition which favoured the original foundation and early growth of the capital of the British Empire has ceased to exercise any influence upon it, and London grows now because the demands of centralized national life require it to grow from the centre that has been fixed by immemorial custom.

South of the Lower Thames Valley the district of the Weald occupies the south-eastern corner of England. The Hampshire Downs, running eastward from Salisbury Plain, divide and proceed as the North Downs and the South Downs to the sea at Dover and Beachy Head respectively. The steep faces of these two lines of Chalk hills look towards each other across the clay-covered plains of Kent and Sussex, separated by the sandstone upland of the Forest Ridges. The northern slope of the North Downs dips below the clay of the Lower Thames Valley, the gentle slope of the South Downs dips similarly below the similar clay of the Plain of Selsey. The rivers rising in the Forest Ridges breach the Chalk ring of the Downs at numerous points, each gap permitting the passage of roads and railways, and each an important strategic point which must be protected in any scheme for the defence of London. The Downs until recently were totally uninhabited ranges of sheep pasture, and though they are now being built upon as the healthiest spots in the immediate neighbourhood of London, the ancient chain of small towns and villages built on the narrow terrace of the Upper

Greensand between the Chalk and the clay remains to attest the harmony established between the village organism and its environment in the days of normal development, before the external attractions of London dwarfed all other considerations.

THE FULANI EMIRATES OF NORTHERN NIGERIA.

By Major J. A. BURDON, F.R.G.S., Resident of the Sokoto Province.

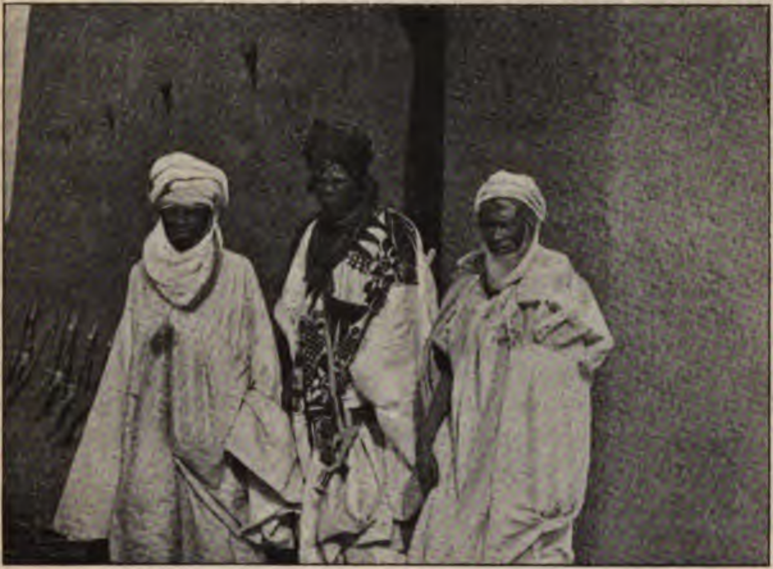
BEFORE turning to the special subject with which this paper deals, namely the Fulani emirates of Northern Nigeria, I think I ought to say a few words on Nigeria as a whole, in order to show why my remarks are confined to one particular district, and to prevent the idea that the description which I shall give is applicable to the whole of Nigeria, or even to the whole of the Northern Protectorate.

Nigeria, an English-made name given for convenience to the British protected territory, the principal feature of which is the lower Niger river, is divided into two Protectorates by a line running east and west at about the 7th parallel of latitude. This line very nearly coincides with a natural boundary—that between the open bush and grasslands of Northern Nigeria and the dense forest of Southern Nigeria. The division is, of course, not as abrupt as such a line would imply. From the Sahara southwards to the coast there is a gradual change in every condition, the central pivot of the change being the increase in rainfall. The sandy plains of the north with their stunted thorn bushes gradually merge into rich soil with a prolific undergrowth and trees of varying value; this grows into the luxuriant vegetation of the dense low-lying forest, with its wealth of timber, rubber, and oils; and this again loses itself in the mangrove swamps of the Niger Delta.

As with climate and nature, so with man. From the light-coloured, straight-featured Fulani, one passes through many gradations to the typical negro of the coast. The characters of the two types are as different as their looks. Ethnology teaches us the effect of environment on race, and it is therefore easy to understand why the forest and swamp-dwellers of the south should be of a lower type than the inhabitants of the open northern plains. But history tells of the southward movement of superior races from the north, and it seems probable that this pressure has forced coastwards inferior aboriginal plain-dwellers. Whatever be the cause, the important point to remember is the very great difference which exists, both in character and appearance, between the inhabitants of the northern plateau and the natives of the southern forests.

England pictures West Africa as peopled by "niggers," by the type of negro whom it helped to degrade by the over-sea slave trade; for the Mohammedan states of Northern Nigeria this picture does not hold good. The offensive name of nigger is as applicable as it is objectionable to the dignified Hausa and Fulani. Not only did this tract escape this product of European civilization, but we have there an entirely different type, a higher race, one from which great things may be hoped in the future, and which will assuredly make its mark in the collection of races that constitute the British Empire.

As with nature and man, so with religion. Islam, from Egypt, from the Mediterranean littoral, from Morocco, has pushed southwards, but during the past century mainly by conquest. Propagated thus by a race of horsemen, it has been effectually checked in its southward march by the tsetse-haunted forests, where no horse can live. And we thus see a steady decline from the devout civilization of Islam, fanatical along the Mediterranean, tolerant south of the Sahara, ignorant and careless towards the southern Fulani emirates, and thence merging into paganism, which increases in degraded superstition till it culminates in the human sacrifices of Benin.



Maijindadi. Mohammadu Maiturare. Malam Akal.

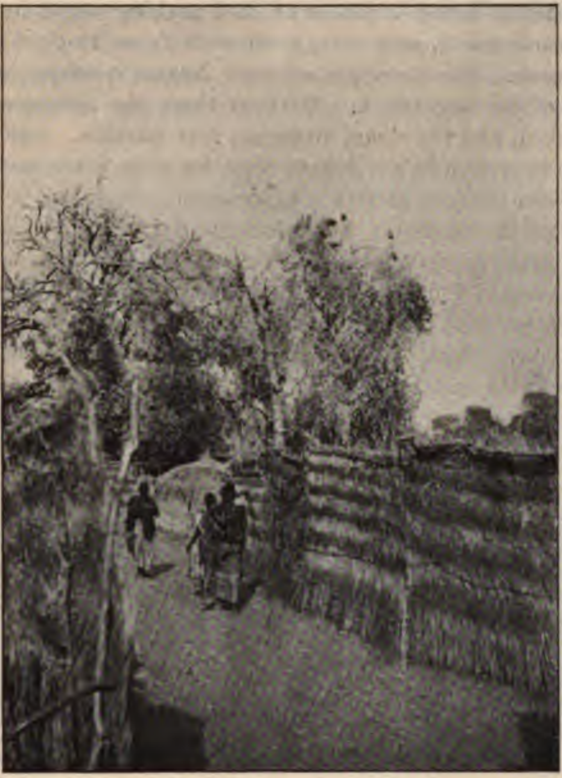
NATIVES OF SOKOTO. MAIJINDADI IS A TYPICAL HAUSA. OH. MAITURARE IS A FULANI ON THE PATERNAL SIDE, BUT HIS MOTHER AND GRANDMOTHER WERE OF NEGRO RACES. MALAM AKAL, ON THE OTHER HAND, IS HAUSA ON THE PATERNAL SIDE, BUT HAS A CERTAIN AMOUNT OF FULANI BLOOD ON THE MATERNAL SIDE.

That there can be no community of interest between the extremes is self-evident; but the important point for British rule is the intense hostility which exists between the two systems, Islam and paganism, at their point of contact. Along the lower Niger and the Benue, stretching east and west between the 8th and 9th parallels of latitude, lies the northern line of paganism, reaching out arms to the north, where inaccessible hills afford protection against the Mohammedan cavalry. Raided incessantly for a century, almost exterminated in parts, these wild tribes regard Islam as synonymous with ruthless aggression, its professors as their natural enemies. Not only can there be no possibility of community of thought or action between types so utterly opposed in language, character, and religion, but I am convinced that in the most improbable event of a concerted attempt by the Mohammedan states to throw off British rule, we could safely rely on this pagan belt to stand fast on our side against their hereditary foes. The converse is also true. Trouble on the lower Benue has no possible connection with any northern state. *À propos* of a recent punitive expedition in the Bassa province, I have come across the wildest ideas as to its possible effect on Nigeria as a whole. There can be no such effect. Isolated risings in these southern pagan tribes affect the Fulani emirates as little as dacoity in Burmah affects India.

With such varying conditions, it is evident that no general description of Northern Nigeria can be given in brief. For such wider view, I would commend all interested to the striking papers read lately by the High Commissioner of Northern Nigeria, Sir Frederick Lugard, before the Royal Geographical Society, and by Lady Lugard before the Royal Colonial Institute and the Society of Arts. And I will now turn to that western portion of Northern Nigeria in which I have served for nearly eight years, and especially to the Fulani emirates of Bida, of which I was Resident for a year, and of Sokoto and Gando, which lie within my present province.

From the northern boundary of British territory, at about the 14th parallel, to the junction of the Niger and Benue just south of the 8th parallel, there extends a laterite plateau, cut in two at about the 10th parallel by the granitic belt in which lie the Niger rapids, and which runs east through the Kontagora and Zaria provinces. The laterite is a thin layer of igneous rock containing a large quantity of iron; it is quite flat, in places covered by a thin layer of soil, which bears scanty grass and stunted trees, in others bare, ringing underfoot, disastrous to the feet of unshod ponies, and very hot and uncomfortable to march over. This ironstone cap overlies various soft rocks, clays, and soft sandstones. Through it the Niger and its affluents have cut themselves broad flat valleys, on either side of which rise steep scarps, increasing in height above the valley-level from 100 feet in the north to some 1000 feet in the south, as the river falls towards the coast, but always ending in the hard straight edge of the plateau table. The rivers are plentiful, and thus the plateau is cut into a succession of table-topped hills.

The hilltops, owing to want of water, are seldom inhabited, and are only cultivated where pressure of population makes the valley lands insufficient. The view through the orchard-like trees is limited to some 50 yards, and in the wet season, when the grass grows over one's head, to little more than one's horse's ears. Grass! A most misleading name to those who only know the soft turf of England. There it means bare blackened earth studded with dried-up tussocks in the dry season, and coarse, overgrown reeds in the rains.



A STREET IN SOKOTO, SHOWING HOW GRASS MATS ARE LARGELY USED AS WALLS, OWING TO THE POORNESS OF THE SOIL AS BUILDING MATERIAL. THE FIGURES ARE WOMEN. THE TREES IN THE BACKGROUND ARE COVERED WITH THE NESTS OF MARABOUT STORKS.

The valleys, where a prolonged state of war has not depopulated the country, are dotted with small walled towns or farm hamlets. The scrub bush is cleared, every acre is cultivated, and the farms are studded, except close to the larger towns, with various accacia and other food-producing trees. The sense of peaceful prosperity is a welcome relief to the monotonous emptiness of the uninhabited bush. It is hard to depict the dreary monotony of the scenery without seeming to make it out utterly unlovely, which it is not. But imagine the same geological formation, the same shape of hill, the same kind of tree, the same type of town, for mile after mile. What would England be like if such geological sameness existed from the Isle of Wight to the Tweed?

The word "river" again conveys an inadequate picture of the waterways of Nigeria—broad expanses of dark rushing water in the rains; blistering sand-tracks, soon overgrown with dense tropical bramble, in the dry season. The tearing floods are Nature's weapon against the luxuriance of the vegetation. Without them the river-courses would become choked, and the rivers disappear into marshes. Such a change has been in operation in the Sokoto river for some years past, but steps have now been taken to restore it to its normal condition.

In the north the rivers flow through flat, marshy plains which, before the grass grows too high, afford pasture to the vast flocks and herds of the nomad Fulani. These marshes are devoid of trees. To the south the rivers flow through belts of dense forest, varying in width from a few yards to half a mile. In these belts, with their fetid pools and impenetrable undergrowth, lurks the deadly tsetse fly, barring the way south to cattle and horses. But, on the other hand, it is in this jungle that are found the valuable forest products, timber, kola trees, and oil palms.

Along the marshy plains and grassy uplands of the north extend the pastoral Fulani, scattered through the territories of the agricultural and trade-loving Hausa peoples, nomads wandering through the lands of town-dwellers. Exactly a century ago a Fulani Sheikh, Othman Dan Fodio, a mallam, or schoolmaster, who had been tutor to Yunfa, the then King of Gobir, forgot his position, and dared to dispute the orders of his old pupil, now his king, and brave his wrath. Yunfa, incensed, ordered his death, and on his resisting, ordered the slaughter of every Fulani in the land. The natural result was that all the threatened race flocked to Othman for their own salvation; and Yunfa, coming with his army to execute his vengence, met a compact body of desperate men, and was utterly routed. This battle of Koto, or Rugga Fakko, fought in 1804, a few miles north of Sokoto, started the Jihad, which ended in placing Fulani rulers over most of the Hausa States and several others.

In its beginnings the struggle was purely racial, the attempted extermination of an alien race by the inhabitants of the land. It was not a sudden, unprovoked religious war for the forcible conversion of the country. Yunfa himself and many of his people were Mohammedans; but apparently the bulk of the Gobir people were still pagans, whilst all the Fulanis were devout Moslems. Consequently, the victory was attributed to the help of God and the power of the faith; and the

Fulani, who had hitherto spread their religion by peaceful proselytism, turned the racial struggle into a Jihad, or religious war. This at once brought to their side large numbers of the indigenous peoples who had already embraced Islam, and thenceforward the struggle became a civil war, or rather a rising to overturn existing authority.

The mallams, the preachers and schoolmasters, who had been the religious leaders of the converts to Islam, now naturally took the leadership of the religious revolts. In Kano and Nupe, to take two historical instances, the old dynasties were thrown down by their own subjects, and the Fulani mallams, as religious leaders, were carried into power on the crest of the religious wave. They took to themselves the palaces and titles of the old kings, and procured a sacred banner and official recognition from Othman, or his representative at Sokoto or Gando. Thus it was that the new states came to regard one or other of these two dynasties as their religious and temporal suzerain. But, with the exception of the leaders who were thus translated to power, the Fulani conquest made little change in the Fulani race as a whole. The typical portion of it still retains its nomad pastoral character.

SOKOTO HORSEMEN.

The great difference existing now between the ruling caste and the herdsmen from whom that caste sprang only a hundred years ago, is most remarkable. The herdsmen are peaceful and inoffensive; they became warriors through the necessity for self-defence; when the crisis passed they reverted to their hereditary occupation; but they are brave in the extreme, trusting for the defence of their treasured herds, their one possession, to neither horses nor armour, but only to their spears and their desperate courage. The ruling caste pride themselves on being warriors, but their trust is in their horses, armour, and drums; they take a very wholesome care of their own skins, and their aggression, unless they are lucky enough to take their enemy by surprise, frequently ends in an ignominious retreat. This is perhaps natural after a century of degeneration; but the curious point is that this was their characteristic in the time of Clapperton, 1826, twenty-two years after their rise. The herdsmen have retained their original abstemiousness and their contempt for finery and comfort of any kind. They are mainly monogamous, and by rigidly abstaining from inter-marriage with the black races have maintained the purity of their type. The rulers, through four generations of polygamy and concubinage with every kind of tribe, have become undistinguishable from the negro—black, burly, and coarse-featured.* They have almost entirely discarded their own language, which is looked on as a rather shameful badge of connection with the despised herdsman. Love of luxury, finery, and pomp is one of their chief characteristics. Sokoto itself, however, is an exception to this last statement; there luxury is considered irreligious. Tradition says that of old every Fulani, both boy and girl, was a scholar. Now, amongst the town-dwellers, it is rare to find an educated man outside the professional scribes and schoolmasters, and even they are mostly Hausas. The boys play truant from school, and the parents are too careless to use compulsion.

And yet in force of character the ruling Fulani is a far finer man than his nomad brother. The latter has an uncivilized, bucolic stupidity; the former is generally a straightforward, intelligent gentleman, pleasant to deal with and work with. He is also a fine ruler, stern, but just and patient. Let me give two instances of the last two qualities.

At the end of 1902, before the occupation of Kano, a native agent of the British Administration was buying transport animals in that city. A Kano trader, having taken his money, refused to hand over the purchases. The agent took the case to the native courts, and though the emir was fortifying his town and openly defying the Government, and though all Kano knew the complainant to be the white man's agent, yet judgment was given in his favour, and, what is more, settlement enforced by the city authorities.

In the middle of 1902, a Resident had a most difficult matter to settle between an emir and a subordinate chief. The latter, a man of a lower race, behaved at the interview in such a foolish, unmannerly way, as to render a settlement apparently impossible. The Resident was on the point of throwing up the matter in despair; but the emir, begging him to have patience, gave him a lesson in diplomacy, and after a couple of hours of most patient and dignified reasoning, won over the reluctant subordinate, and achieved the settlement where the white man had failed.

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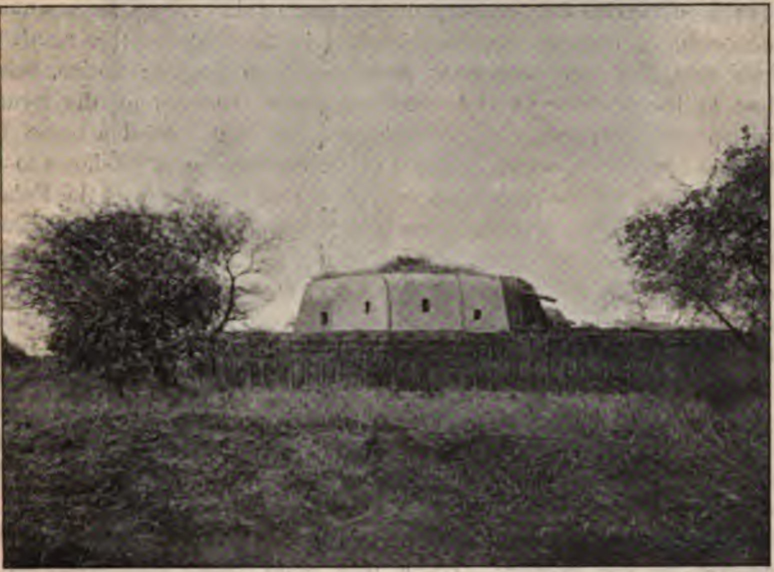
* Sar. Musl. Marafa.

Of course, one obvious reason for this development of character and intellect is the position, duties, and responsibilities of rule. But I believe that admixture with the more sturdy black type, the agriculturist, trader, artisan, and townsman in general, has had much to do with the evolution of the simple shepherd into the courteous man of the world. The difference that, I am told, exists between the Fulani rulers I am describing and those of the eastern provinces tends to confirm this view. It may be that residence amongst peoples lower than these of the west has tended to lower the type. But there remains the fact that they have retained their own language and to some extent their purity of race. This probably has something to do with their less amiable character.



THE TOMB OF OTHMAN DAN FODIO AT SOKOTO. THE BUILDING SHOWS THE BEST ARCHITECTURAL EFFORTS OF THE FULANI, WHO ARE FAR BEHIND THE HAUSAS OF KANO IN THIS RESPECT. IN FRONT OF THE TOMB IS A GRASS-MAT WALL. THE TOMB IS CAREFULLY LOOKED AFTER AND KEPT IN GOOD REPAIR. IT IS AN OBJECT OF VENERATION TO THE FULANIS AND TO THE MOHAMMEDANS OF NORTHERN NIGERIA IN GENERAL.

The degree of resistance to the Fulani conquest varied very greatly in various parts. Kano, desirous of peace for the sake of trade, settled down very quickly. Katsena endured a siege like that of Troy. Kebbi, after a few years' acceptance of Fulani rule, revolted, and has maintained its independence ever since. And Gobir, against which the Jihad originated, has never been conquered at all. The existence of these two foci of independence has undoubtedly made for peaceful settlement throughout the remainder of the Sokoto province; for malcontents, instead of continually revolting as they did in Nupe, simply migrated into the independent territories. To the south, where there was no pre-existing Mohammedanism to pave the way for the Jihad and assist it by civil war, the result of the Fulani conquest has been wholesale depopulation. Refusal either to accept Islam, or to submit and pay tribute, postulates war to followers of the Koran. So whole districts have been carried into slavery or driven to take refuge in mountain fastnesses. Unhappily for the Fulani, it is this district, this result of their rule, that has come most prominently to English notice, being close to the waterways and therefore under the eyes of the former British administrators. And the Fulani has thus earned a name for ruthless oppression, which under happier circumstances he shows to be undeserved. Where prolonged resistance was not the case, the Fulani conquest of Hausaland seems to me to have been similar to, only far milder than, the Norman conquest of England. The indigenous populations retained their lands and hereditary offices. Only the dynasties changed. And apparently the new rulers accepted and carried on the constitutions they found in the various states.

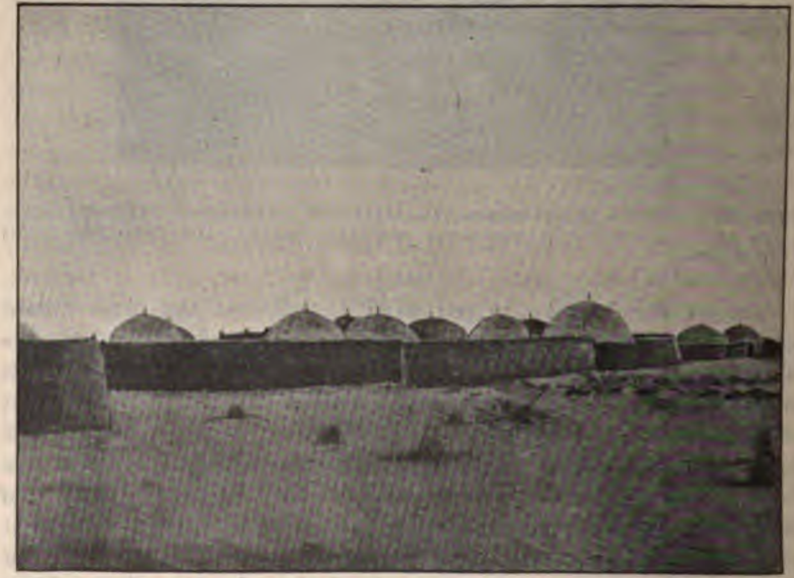
The details of the state systems differ considerably in the different emirates; but underlying them all is the very deep-rooted desire for constitutional government. The emirs are elected by the will of the people as voiced by the Council of Elders, and this council must be consulted by them in their public acts. The fact that a district chief does not command the loyalty of his people is a sufficient reason for his removal by his overlord. On a new chief being nominated, he is presented to the headmen of his district or town, and they are asked whether he is the man they desire and will obey. And the most serious charge that can be made against an emir is that he rules without consulting his council. Such an one was Abd Errahman, the emir of Sokoto, who died in the autumn of 1902. He was a veritable tyrant, neglecting the advice of his officers, guilty of most arbitrary and unconstitutional acts, choosing his subordinate chiefs without reference to the wishes of their subjects, thereby causing frequent civil wars, and allowing his sons to annex, misrule, and oppress in a way that made both his name and theirs to stink in the nostrils of his people. And so he won his nickname, Dainyan Kwosko, "the unbaked potsherd," the jar that cannot be trusted to carry water, the untrustworthy; and by this name he was known and hated throughout the length and breadth of Hausaland. But as Sarikin Muslimin, to give him his native title, Emir Al Mumenin, Commander of the Faithful, he was both endured and obeyed (with one notable exception) to the day of his death, a fact which speaks well for the law-abiding instincts of his people.

THE SARIKIN (= KING OF) TAMBAWEL, AN IMPORTANT TOWN SOUTH-WEST OF SOKOTO. IN THE BACKGROUND IS THE HIGH SUN-DRIED BRICK WALL SURROUNDING HIS COMPOUND.

But let me describe to you what I regard as the ideal Fulani constitution, that of Bida. In the first place, the fundamental principle is the intense veneration for age which the Fulani and Hausas possess in common with the Arabs and other Semitic races. With them our admiration for the energy of youth has no place, nor can they appreciate our frame of mind that despises dotards and senile folly. Promotion through the various offices of state up to the highest is a matter of selection based mainly on seniority.

The state at Bida is composed of three parts, very comparable to our three estates of the realm. At the head there is the emir, or king, with whose appointment I shall deal later. Next to him is the Council of Princes, corresponding to our House of Lords, not hereditary as from father to son, but only so as confined to members of the ruling family, descendants of the founder of the dynasty. It consists of a succession of titles or offices in a carefully graduated order of precedence. The method of appointment is most interesting. The emir allows it to get about that he thinks of making a certain appointment or promotion. If the individual mentioned desires the post, he goes and asks the emir to give it him. If he does not do so, it is a sign that he does not want the rank, and another name is suggested. If the emir receives the request, he promises it his favourable consideration, allows this fact to be published, and then waits for a month or so to see whether the proposal is acceptable to the people. If no notice is taken of the suggested promotion, the matter is dropped as unpopular. But if congratulations pour in, and the officer elect begins to be universally addressed by the new rank which is promised him, it is a certain sign that the appointment meets with approval, and it is then carried into effect. Is not this a very striking form of the idea of representative government? When the day comes when we may take the native into a still closer association with ourselves in the administration of the country, here is the nucleus of representation and self-government ready to build on.

Through these Council of Princes the future emir enters the service of the state, climbing the ladder of promotion by force of character,



NATIVE COMPOUNDS, SOKOTO. THIS SHOWS THE TYPE OF HOUSE USED BY THE UPPER CLASSES—A GROUP OF HUTS, ROUND OR SQUARE, SURROUNDED BY A 6-FEET MUD WALL.

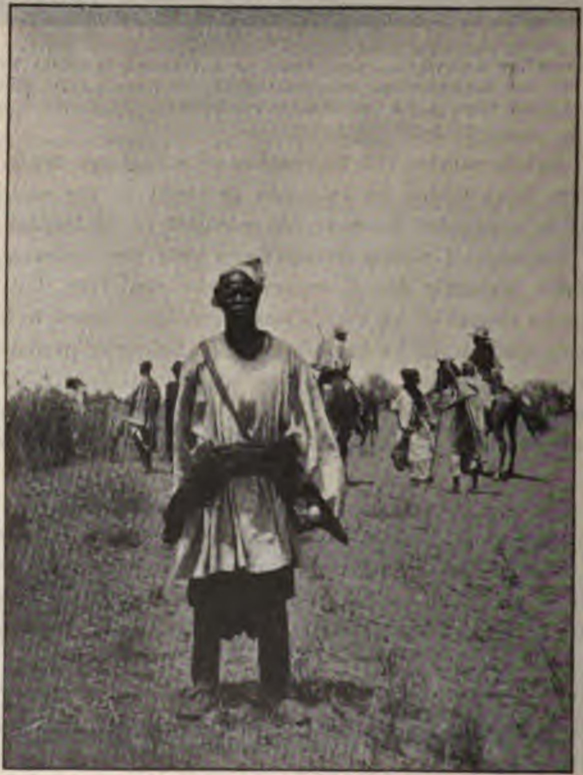
NATIVE HORSEMEN AT SAINYINNA. THE TOWN OF SAINYINNA IS SHOWN BY THE LINE OF TREES IN THE BACKGROUND. THE FOREGROUND IS FARM LAND—STUBBLE. THE SCENERY IS VERY TYPICAL OF THE SOKOTO PROVINCE.

wealth, and public service till he reaches at a ripe age the position of heir-apparent, from which he succeeds by right to the emirate. His first act then is to appoint his heir, his selection being limited to those members of the council whose fathers have held the emirate, and who are themselves generally fitted, especially by seniority, for the post. There can be no chance of an emir's son succeeding direct to his father. He is a mere nobody until he has climbed the ladder of promotion along with his cousins and other distant members of his family. Of course such a system gives rise to much favouritism and bitter quarrels; but, on the other hand, it is a safeguard against incompetence and rank unfitness.

And third comes the Council of Commoners, our House of Commons. This is composed of all men not of royal blood holding important state offices, the waziri, vizier or prime minister, the commander-in-chief, chief justice, chief liman or preacher, and the principal officers of the emir's household, these latter being mostly slaves. The method of appointment to this branch is very much as for the other. The two branches do not deliberate separately or apart from the emir, and only when called on by him. The whole council must be summoned for the consideration of all important matters; but the ordinary routine of state is carried on by a privy council composed of the two principal officers of each branch, who are in constant consultation with the emir. But it is important to note that the head of the council is the waziri, the leading commoner; it is he who is second man in the state, not the heir-apparent.

It appears to me an extraordinary thing that a race of nomad shepherds, whose own system was probably purely patriarchal, should have been able to build up such a constitution. I cannot help thinking that the Fulani conquerors must have found it in existence with the Nupe dynasty they deposed. Two facts seem to point this way. First, the names of the titles and offices are mainly Nupe, and not Hausa or Fulani. And second, no such elaborate constitution exists in Sokoto or Gando, which are not old indigenous states, but were carved out by the conquerors from the outskirts of states which continued to exist, Gobir and Kebbi.

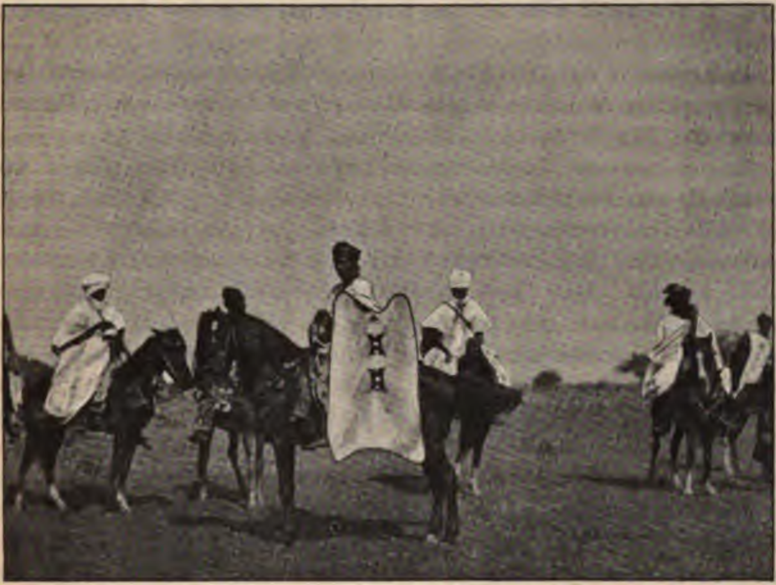
I may perhaps have given you too rose-coloured a picture of the Fulani. He has, as I have hinted, his dark side of oppression of subordinate races, enslavement of those who resist him. But I hold that to get the best out of a man one must find out the best that is in



JABUMAI, THE CONFIDENTIAL MESSENGER OF THE EMIR OF ARGUNGU, SHOWING THE DRESS OF A MOUNTED MAN FOR ROUGH WORK. THE SUBJECT IS A HAUSA, A NATIVE OF KEBBI.

him. It is that best that I consider, and which I have tried to picture to you.

If I have succeeded in infecting you with any of the admiration I feel for these systems and their rulers, your natural question will be, "What is the attitude of the British Administration towards these states?" Briefly, it is construction, not destruction. Our aim is to rule through the existing chiefs, to raise them in the administrative scale, to enlist them on our side in the work of progress and good government. We cannot do without them. To rule directly would require an army of British magistrates, which both the general unhealthiness of the country and its present poverty forbid. My hope is that we may make of these born rulers a high type of British official, working for the good of their subjects in accordance with the ideals of British Empire, but carrying on all that is best in the constitution they have evolved for themselves, the one best understood by, and therefore best suited to, the people. Our present task is to gain their confidence. Without this there can be no real progress. The first step is to uphold and strengthen their authority over their subjects. This has necessarily been greatly weakened by their defeats at our hands. Its rehabilitation is slowly progressing, and is gradually inducing a sense of gratitude and trust.



GROUP OF NATIVE HORSEMEN, SHOWING PARTICULARLY THE ASBEN OR TUAREK SHIELD, MADE FROM THE SKIN OF A WHITE ANTELOPE (SOME SPECIES OF ORYX) FOUND IN THE SOUTHERN PART OF THE SAHARA.

Since the fall of Sokoto and Kano the papers have frequently spoken of "the downfall of Fulani rule." Inasmuch as the Fulani was previously supreme, and has now had to acknowledge a superior, the expression is accurate. But from the point of view of the subject population it is not true. The Fulani still rules, collects taxes, and administers justice. It is their old dynasty that the people have to obey, and therefore it cannot be said that the Fulani empire has fallen. Such a statement pictures the wiping out of an existing dynasty, the usurpation of kingship by a conquering race, and it is therefore misleading to the British public. There is, of course, a suzerain power which guides the ruler, a supreme court of appeal beyond him. But what has happened is that the Fulani States have become self-governed portions of a world-wide empire, not that as states they have ceased to exist.

And what is the attitude of our new fellow-subjects towards us? Our occupation is too recent to allow of a definite answer. Farmers whom the Pax Britannica has allowed to flock back to their long-desolate homes and lands; traders who are safe from pillage and extortion; war-swept towns which can now sleep in peace; individuals and individual communities are grateful for the benefits we have conferred. And this gratitude I believe will increase till it permeates public opinion. But there cannot but be an underlying feeling of resentment for some time to come. Rulers who have been deprived of their absolute power cannot be grateful, even though they are now bound to us by ties of self-interest. At present they are only grateful in a negative way, intensely relieved to find that the conquest they so dreaded interferes with them so little, and with their religion not at all.

A most important factor for the future is the intensity or otherwise of Mohammedan fanaticism. In this respect we have cause for thankfulness. The sect to which the Emir of Sokoto and the vast bulk of his religious adherents belong is that of the Kadiriyah, the most tolerant sect known to Islam. And the Senussiyah, the thundercloud of North Africa, have obtained no footing in the states that acknowledge the representative of Othman Dan Fodio as Commander of the Faithful, and are not likely to do so as long as his religious influence remains.

I personally am sanguine enough to hope that the present negative feeling may be fostered into active loyalty. A little while ago, in a town where less than a year before men had died happy cursing us as infidels, the Resident lay dangerously ill. He was publicly prayed for throughout the mosques. The fact came to his knowledge accidentally after his recovery. It is easy to lay undue stress on this incident. But remember what Mohammedanism means, and I think you will agree with me that the possibility of such an act gives the most hopeful augury for the future of British administration amongst these latest recruits to our Mohammedan fellow-subjects of the King.

CAPTAIN J. LIDDELL'S JOURNEYS IN THE WHITE NILE REGION.*

We have received from Captain J. Liddell, Director of Posts and Telegraphs in the Anglo-Egyptian Sudan, an account of some journeys made by him early in 1904, in the country bordering the White Nile on the east, between 6° and 10° N. Coming from Meshra-er-Rek in the Bahr-el-Ghazal province, Captain Liddell struck the Nile at Shambe, and ascended by steamer to Abu Kuka (a little village south of 7° N.), his object being to try to push east of the Bahr-el-Jebel to the Twi district, while it seemed possible that the country in this direction might here be less swampy than elsewhere. On making the attempt, however, the swamps proved impassable on foot, though information was obtained which showed that water-communication exists between Abu Kuka and Twi. On endeavouring to trace this waterway in dug-out canoes, Captain Liddell passed by a "spill" from the Bahr-el-Jebel into a swift-flowing river, called by the Dinkas Abogwi, which, so far as seen, would be easily navigable for a steamer; time, however, did not admit of his reaching Twi, it being necessary to catch the steamer going north, and further exploration here was postponed for the time being.

Proceeding down the Nile to Taufikia, near the Sobat mouth, Captain Liddell started for Twi on February 25, with camels and an escort of twenty gehadia, by an overland route to the east of the Bahr-el-Zeraf. During the first few days several khors were crossed, the two first having Shilluk villages on their banks; they were from 200 to 300 yards in width, and, though nearly dry at the time, would be beyond a man's depth in the rains. Khor Diar is said to come from a large "birka" at Duk (this being fed by a khor which comes from the Bahr-el-Jebel at Bor), and to join the Bahr-el-Zeraf just south of the Jebel zeraf visible hereabouts across the plain. When there is a high Nile, it is said to flood a large area. The country is an open plain, with "heglik" trees and small talha scrub in places. For a few miles north of the Dinka village of Fulfam, the preceding high Nile had flooded the country—an exceptional occurrence—and ruined the crops. The homesteads, both at Fulfam and in all the villages as far as Twi, are very much scattered. As the water in the "fulas" (tanks) becomes low, the natives dig a series of circular holes round their circumference and of a greater depth, draining the water into them in order to economize it as much as possible. Beyond Fulfam the country had again been flooded by the exceptionally high Nile, the water coming from two khors which lie further east, and are said to leave the Nile at Bor. Jual is a village of considerable extent, containing a mixed population of Dinkas and Nuers—the former apparently predominating. The people own considerable numbers of cattle, some of which they graze near the Bahr-el-Zeraf, and some inland to the east. Both this village and another named Lual are under a female sheikh, chosen as successor to her father, who had built a big "kenisa," or church, and had no sons. The sheikh of Khandak, Faragalla by name, was a Dinka who had been in the old army at the fall of Khartum, and can read and write. He was most friendly, and seemed to stand in some awe of his Nuer neighbour Diu, who is said to have joined Dengkur, a chief against whom a Government expedition was lately sent. The Nuers about here seem to raid the Dinkas a good deal, though some of the former on the Zeraf were said to wish to have Faragalla as their chief, probably to escape any possible reprisals that may be made against Diu.

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* Map, p. 708.

DINKAS AT SHAWAI.

Beyond Khandak the route still led across a flat plain, liable to be flooded when there is a high Nile. Between this and the Zeraf the khors and swamps make the country impracticable, and Captain Liddell was forced to give up the idea of striking for the river on the return journey to meet a launch which he had arranged should

DINKAS AT KHANDAH.

be ready for him. At Luang Deng there was formerly a noted "Kenisa," the sheikh having a great reputation as a holy man; but there are now only a couple of "tukls," in one of which are kept a number of old guns taken by Diu from the Dervishes sent against him from Bor under Emir Elias.

The Dinkas of the districts now reached proved to be much more powerful than those further north, and consequently less afraid of the Nuers. As far as Fataltun, the road traversed an almost continuous series of villages, but beyond this the country was uninhabited, except for a few wandering Dinkas, who were out collecting "alob" (heglik berries). About here the transport animals were much worried, first by a small fly called "rung," afterwards by "serut" flies. Near Pabek there were indications that the inundation had been about 18 inches deep. The place lies on the edge of a swamp which separates it from its "meshra" (landing-place) on the Mading river, which Captain Liddell was anxious to visit, but found it impossible to do so without canoes. He learnt from the chief Gurung that it was here that Mr. Grogan's party was attacked during his journey north through this district, and the people held aloof from fear of reprisals. Enough had, however, been seen of the country to show that it would be unsuitable, owing to its liability to be flooded, for the route of a telegraph line, and Captain Liddell therefore decided to turn back. He found the country drier than on the outward journey, and the route is said to be, as a rule, used only in the wet season, one near the Zeraf being used in the "seif," or hot weather. The latter was, however, impassable at the time, owing to the exceptionally high flood. From Luang Deng there was formerly a track to the Khor Filus (Sobat system), and the natives talk of re-opening it. All along the road numbers of giraffe were seen, and at some seasons elephants must be numerous. Ostrich, roan antelope, "tiang," etc., were also seen, and in several places there were hippopotamus tracks.

A few weeks later Captain Liddell was back at Shambe, and made another attempt, in company with Sir W. Garstin, to explore the waterways leading from the Nile to the Twi district—this time by "spills" which had been found to run into the Jebel near Shambe, from the Awai river. On May 8 these were entered by a steamer towing a barge and telegraph launch, and the Awai was ascended to the western end of Akwoit island, where were a number of temporary Dinka villages. Further on the channel narrowed, the barge and launch

DINKA GIRLS POUNDING DURRA.

brushing through the grass. On the following day the steamer stuck near the junction of the Atem and Mading with the Awai, but, proceeding in the launch, the party went down the Mading as far as Gurung's "Meshra." All three rivers swarm with hippopotamus. Afterwards the Awai was explored below the spill into the main river, and was found to lead to a series of lakes reached by Colonel Peake from Shambe during the sudd-cutting operations, the steamer then turning back. Subsequently inquiries were made at Bor as to the channel by which the Dervishers had made their way to Twi, but no such channel could be found. Returning, therefore, to the point of junction of the Awai, Atem, and Mading, the last-named was traced till it became very small, a mile before its final disappearance. Up-stream, on the Atem, firm ground with forest containing fine trees approached close to the east bank, which remains good as far as Tu, the southernmost village of Fakeir, itself the southern district of Twi. The river was said to be blocked by sudd some 10 miles further on. It varies considerably in width and depth, but the least depth found, in the best channel, was 4 feet. The Mading is at first a fine river 80 yards wide, but most of the water soon spills away into the marsh. The Awai is, as a rule, a deep river (9 to 12 feet), but there are shallower parts, and its width varies very much. All along the Awai and Atem there are innumerable "mayas" and spills in and out of the rivers.

The accompanying map is a reduction of Captain Liddell's sketch, which was based on—

(1) A compass sketch from Taufikia to Twi, with halting-places fixed astronomically.

(2) Captain Lyons' survey of the Bahr-el-Jebel.

(3) A compass sketch of the channels between Twi and Shambe adjusted to Captain Lyons' survey.

ON THE ZONAL DISTRIBUTION OF SOUTH ATLANTIC AND ANTARCTIC VEGETATION.*

PRELIMINARY REPORT.

By C. SKOTTSBERG, Botanist of the Swedish Antarctic Expedition, 1901—1903.

ONE of the most important objects for the Swedish Antarctic Expedition was to investigate all biological, and especially zoo- and phyto-geographical, conditions in the southern lands and around their coasts. Fortunately, I had good opportunities of studying the nature of different countries; those in which I have been able to make botanical observations are the Falkland islands, South Georgia, Tierra del Fuego, the Isla de los Estados, the South Shetland islands, and Graham Land, with a number of islets near its coasts.

Here I can only make a preliminary communication as to the phytogeographical results obtained, leaving all details for another paper.

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* Map, p. 657.

I. The Land Vegetation.

Which vegetation has the right to be regarded as Antarctic?

Before we had any knowledge that a real vegetable life exists in Antarctic lands, one used to comprehend the floras of the Tierra del Fuego, South Georgia, the Falkland islands, Kerguelen Land, the Auckland group, etc., together with the faint traces of a plant life found in the neighbourhood of Graham Land, under the name of *Flora antarctica*.[*] But if we have regard to the present geographical definition of the Antarctic zone, we find at once that a great section of the above-mentioned floras cannot with any right claim to be designated Antarctic. The geographical principle, which takes the normal northern extension of drift sea-ice (not icebergs) as the northern limit of the Antarctic region, seems to me rather natural; and Graham Land, with its islands, the South Shetlands, the South Orkneys, and South Georgia, with the South Sandwich islands, though within the Atlantic, have thus to be considered as Antarctic. From my study of the vegetation in some of these regions, I am of opinion that it is not in all cases truly Antarctic, still less so in the case of the Falkland islands or Tierra del Fuego.

It seems to me appropriate, for the lands south of 40–50° S, to propose the following phytogeographical zones: the *Austral* zone, including Tierra del Fuego, with the Isla de los Estados, the Falkland islands, South Georgia, and no doubt also the South Sandwich islands; and the *Antarctic* zone, including South Orkney and South Shetland islands, and Graham Land, with its surrounding groups of islands. The Austral zone is characterized by a climate which permits the existence of forests or grassland; the Antarctic climate giving origin to a cold desert.[†]

If we survey the vegetation of the Austral regions, we shall find, going from the west to the east, the luxuriant forests of West Fuegia gradually change into the South Georgian grassland, which exists under very hard conditions, and therefore is very poor.

Tierra del Fuego.—Brought by the predominating westerly and south-westerly winds, a very great quantity of rain and snow drenches the south and west Fuegian islands. The following table[‡] speaks in the main for itself. As to the great mass of

Tierra del Fuego, Orange Bay. Lat. 55° 31′ S., Long. 68° 5′ W. 1882–83.

Month.	Mean temperature. Fahr.	Means of max. temperature. Fahr.	Means of min. temperature. Fahr.	Mean humidity of air. Per cent.	Mean strength of wind. Ft. per sec.	Days with rain or snow.	Days with snow.	Rain and snow. Inches.
	°	°	°					
October ...	42·40	51·42	34·66	83·3	18·0	26	6	3·2
November ...	44·29	53·20	36·59	82·4	24·5	28	3	5·0
December ...	46·22	55·45	38·32	83·0	24·7	29	2	5·9
January ...	46·00	51·35	38·82	83·1	30·1	28	7	6·4
February ...	48·05	60·33	39·79	80·6	25·5	27	2	3·4
March	42·62	51·26	36·91	79·5	21·6	26	4	6·0
April	40·89	46·87	35·17	83·9	19·3	26	4	7·0
May	39·91	44·98	34·88	83·2	19·5	25	9	4·5
June	36·19	40·30	31·37	88·1	18·2	23	9	4·8
July	37·76	42·78	35·54	82·0	19·8	21	11	1·5
August ...	37·45	43·70	32·09	76·1	19·3	25	13	5·4
Year (eleven months)	41·98	49·24	35·83	82·3	21·9	284	70	53·1

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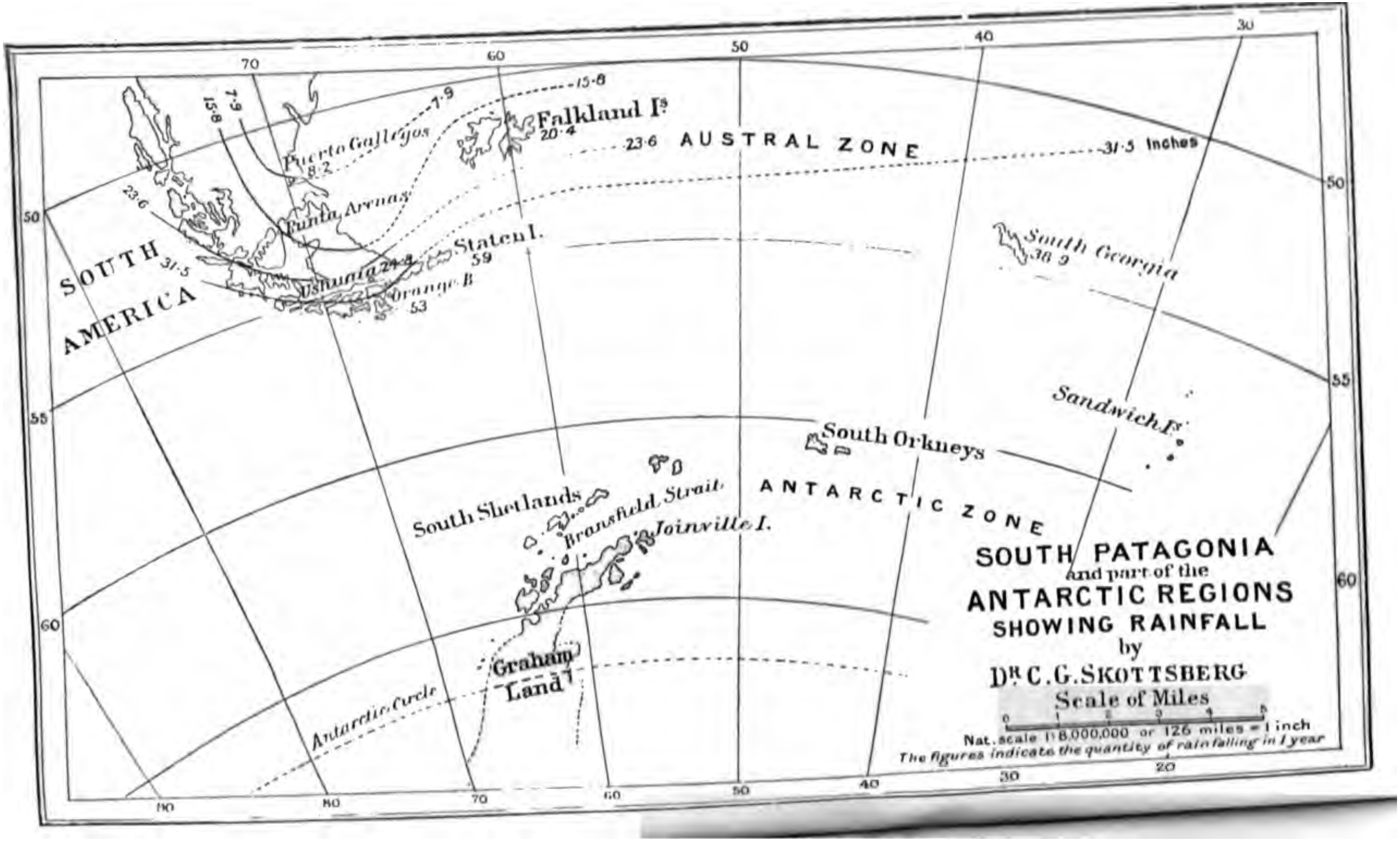
[*] For instance, Drude, 'Atlas der Pflazenverbeitung.' Gotha: 1887.

[†] Schimper, 'Pflanzengeographie,' p. 177. Jena: 1898.

[‡] My information on the Fuegian climate is from 'Mission Scientifique du Cap Horn, 1882–83,' t. ii. Paris: 1885.


SOUTH PATAGONIA
and part of the
ANTARCTIC REGIONS
SHOWING RAINFALL
by
Dr. C. G. SKOTTSBERG
Scale of Miles
0 1 2 3 4 5
Nat. scale 1:8,000,000 or 126 miles = 1 inch
The figures indicate the quantity of rain falling in 1 year
AUSTRAL ZONE
ANTARCTIC ZONE
SOUTH AMERICA
Falkland Is
20·4
Puerto Gallegos
8·2
Punta Arenas
Ushuaia 24·4
Staten I.
59
Orange B.
53
South Georgia
38·9
Sandwich Is
South Orkneys
South Shetlands
Bransfield Strait
Joinville I.
Graham Land
Antarctic Circle
7·9
15·8
23·6
31·5
31·5 inches
70
60
50
40
30
55
90
80
20

rain and snow, I find it rather remarkable that the number of snowy days is so great. But a glance at the more detailed table shows that the snow very often appears mixed with rain; and that falls of pure snow even at a lower temperature are rare. Thus, it is easy to understand that the snow never lies many hours in the forest, being half melted when falling. The direction of the wind is mostly west-south-west, and the strength very great. The sky is very cloudy, and the humidity of the air great.

These climatological conditions have nourished a typical rain-forest. It consists mainly of a kind of beech, the *Nothofagus betuloides* (Mirb.), Blume, a low tree with small leathery leaves. This, as well as two other trees rather common amongst the beech, *Drimys Winteri* (Forst.) and *Maytenus magellanica* (Lam.), Hook. fil., is evergreen. The *Nothofagus antarctica* (Forst.), Blume, which is deciduous, plays a part only above the limits of the evergreens, the climatological factors allowing it to climb the mountains much higher up than this. The ground vegetation in the forests is very remarkable. It consists of carpets of exceedingly luxuriant *hepaticæ*, of many types and species, while the phanerogamic are rather sparely represented. As a characteristic species, climbing the trunks of the trees, I only mention the *Lebetanthus myrsinites* (Lam.), Endl.

As the map shows, the rainy region makes a curve towards the north-east, including the Isla de los Estados. Here we find the largest quantity of annual rain observed in the regions treated in this paper—not less than 1500 mm.* The main character of the forest is quite the same as in other parts of the rainy zone. Towards the north and east this zone presently passes into a region with much less rain; here Ushuaia, the Fuegian capital, is a station for meteorological observations. I refer to the publications by the 'Mission scientifique du Cap Horn,' and the paper by Dr. Chavanne. Unfortunately, this paper only shows the average temperature and rainfall for the four seasons, and not for the months, nor the specially important averages of the extreme temperatures †; as to the quantity of snow there is no information.

Tierra del Fuego, Ushuaia. Lat. 54° 49′ 30″ S., Long. 68° 18′ 8″ W. 1882–3.

Months.	Mean temperature. Fahr.	Means of max. temperature. Fahr.	Means of min. temperature. Fahr.	Mean humidity of air. Per cent.	Mean strength of wind. Ft. per sec.	Days with rain or snow.	Days with snow.	Rain and snow. Inches.
	°	°	°					
December ...	49·57	59·67	38·91	73·4	7·5	14	0	2·5
January ...	49·55	58·87	39·72	75·8	7·5	19	1	2·3
February ...	52·02	64·54	38·57	75·4	8·8	12	1	1·8
March	45·80	58·33	36·55	79·8	6·9	18	0	3·1
April	42·46	50·45	33·10	75·1	6·9	15	5	2·0
May	39·61	48·36	32·57	75·2	7·2	19	3	1·9
June	35·11	41·07	28·60	78·9	4·9	13	5	2·2
July	37·24	45·03	30·13	72·4	6·5	8	5	1·3
August ...	40·01	48·81	31·60	72·0	6·2	9	3	1·4
September ...	39·40	48·95	31·42	75·1	4·9	14	6	2·9
October ...	46·49	54·80	35·74	67·8	6·2	14	0	1·8
November ...	46·18	53·87	37·02	64·5	6·9	15	2	3·1
Year	43·63	52·73	34·50	73·8	6·7	170	31	26·3

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* Chavanne, 'Die Temperatur und Regenverhältnisse Argentiniens. Veröff. der Deutschen Akademischen Vereinigung.' Buenos Aires: 1903.

† Schimper, *l.c.*, p. 191.

USHUAIA. OBSERVATIONS DURING TEN YEARS. AFTER CHAVANNE.

Season.	Mean temperature. Fahr.	Rain and snow. Inches.
	°	
Spring	43·70	4·02
Summer	50·18	8·50
Autumn	42·80	7·56
Winter	34·70	4·72
Year	42·84	24·80

The tables show distinctly the difference between this climate and that referred to above. But they do not give an exact idea of the snow conditions in this part: one would think that, in the rainy region, we should also get more snow. It would have been a great advantage to have had exact figures of the quantity of snow falling, not only the days with snow. Very likely the quantity is greater in Ushuaia than in Orange bay.

And there is an important difference bearing on the constitution of forests: according to our experience of the winter round Ushuaia (September 16 to November 5, 1902), big masses of snow lie in the forests for weeks. The direction of wind is about the same, but there is a great difference as to strength. The nebulosity and relative humidity of air are less too.

The vegetation completely corresponds to the climate. Here we meet with summer-green forests, in the winter presenting about the same aspect as those in Scandinavia. *Nothofagus antarctica* (Forst.), Blume, prevails, mixed with rare and tiny specimens of *N. betuloides* (Mirb.), Blume, *Maytenus magellanica* (Lam.), Hook. fil., and *Drimys Winteri* (Forst.). Also here *N. betuloides* does not go so high above the sea-level as *N. antarctica* (Forst.), Blume. The bushes in the wood are here, as well as further south, evergreen. The ground in the summer-green forest is destitute of a coherent moss carpet; the open spaces are occupied by meadows; the *hepaticæ* are few in number in comparison with the *musci*.

After passing the ridge of the Cordillera, the wind has parted with most of its humidity, and the climate of eastern Fuegia and Patagonia gets more and more dry. The vegetation gradually becomes rather poor and sterile, only the rivers being surrounded by woods. As an example, I may mention Puerto Gallegos in 51° 39′ S., 69° 13′ W., where meteorological observations have been made during two years.

PATAGONIA, PUERTO GALLEGOS. LAT. 51° 39′ S., LONG. 69° 13′ W. AFTER CHAVANNE.

Season.	Mean temperature of air. Fahr.	Rain and snow. Inches.
	°	
Spring	46·22	1·10
Summer	54·68	1·41
Autumn	45·32	3·42
Winter	35·24	2·28
Year	45·36	8·21

The Falkland Islands.—The south-west winds have to pass a broad space of water on their way to the Falkland islands; and, though we cannot expect the same quantity of rain as in southern Fuegia, it is not surprising that the rainfall is considerably greater than in the corresponding latitude on the eastern coast of South America. It is true that the quantity of rain is smaller than round Ushuaia, but nevertheless it must be considered as quite sufficient for a summer-green forest; yet on these large islands there does not exist a wild tree—the ground is covered by a boggy grassland.

Schimper[*] considers the climate of the Falkland islands as warm-temperate—in my opinion without any reason; the tables show that no month reaches an annual medium of 50° Fahr., and therefore the cold-temperate might be a more adequate designation.

As Schimper points out, the climate is especially favourable for the existence of grassland and meadows. But this fact does not account for the complete absence of any arboreous vegetation.

Falkland Islands, Port Stanley. Lat. 51° 41′ S., Long. 57° 51′ W. 1875–77.

Zeitschrift d. oesterr. Gesellsch. f. Meteorologie, B. xvi. (Wien, 1881).

Month.	Mean temperature. Fahr.	Means of max. temperature. Fahr.	Means of min. temperature. Fahr.	Mean humidity of air. Per cent.	Days with rain or snow.	Rain and snow. Inches.
	°	°	°			
December	46·76	53·06	40·46	76	21·0	2·0
January	49·64	56·12	43·16	72	21·3	2·7
February	48·56	55·04	42·08	76	19·3	2·2
March	48·56	54·32	42·80	81	18·3	1·7
April	43·88	49·10	37·40	84	22·3	2·1
May	40·28	44·60	35·96	90	19·3	1·7
June	37·94	41·54	34·16	91	20·0	1·5
July	36·50	40·64	32·36	91	20·3	1·8
August	37·58	42·08	33·08	88	22·0	1·2
September	39·92	45·14	34·70	81	15·7	1·1
October	41·00	46·40	35·60	82	21·3	1·3
November	44·78	50·54	39·02	76	15·3	1·1
Year	42·94	48·21	37·57	82	236·1	20·4

Without doubt, the rain is sufficient for a summer-green forest, but it is too uniformly distributed over the twelve months. And, what the table does not tell, the ground is deprived of a cover of snow; we cannot take into account the more or less extensive but always thin patches which sometimes cover the ground, especially the slopes of the mountains, for a week or so.[†] This want of snow in the winter and spring, combined with an exceedingly strong wind from the south-west, blowing day after day at relative low temperatures, has, I dare say, influenced the characters of the Falkland vegetation. Large areas of the ground consist of peat. Nowhere, especially on the eastern island, is there any shelter from the wind.

If we look at the distribution of rain in the four seasons, we shall find that winter and spring show the smallest quantities. It is of interest that the wind at that time of the year blows more from the west and north-west; summer and autumn, with south-west and south wind, are richer in rain. Calm days are more common in the winter, but always rare. The winter temperature is not very low, seldom lower than some degrees below freezing, but always, together with the heavy gales, very dangerous for trees, which are not then able to recover the moisture lost by transpiration.

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[*] *L.c.*, p. 481.

[†] The winter—July, August, 1902—we stayed there was considered the strongest for at least fifteen years.

South Georgia.—We might expect South Georgia to receive a great quantity of rain or snow from the winds of the ocean, and the observations made hitherto confirm this. On the contrary to the case of the Falkland islands, we here meet with a high land covered with ice, which sends glaciers down to the fiords. In spite of that, the general aspect of the island is not quite Antarctic, owing to the large areas of lowland with vegetation.

SOUTH GEORGIA, ROYAL BAY, LAT. 54° 31′ S., LONG. 36° W. GERMAN STATION, 1882–83.

Month.	Mean temperature. Fahr.	Means of max. temperature. Fahr.	Means of min. temperature. Fahr.	Mean humidity of air. Per cent.	Mean strength of wind. Ft. per sec.	Days with rain or snow.	Days with snow.	Rain and snow. Inches.
	°	°	°					
September ...	30·38	35·60	25·34	—	25·3	10	9	5·0
October ...	34·34	39·20	29·66	—	21·6	26	21	4·6
November ...	37·22	41·90	32·54	76·2	17·1	29	19	2·8
December ...	38·66	43·70	34·34	73·9	23·6	30	19	2·9
January ...	40·28	44·96	35·96	71·9	20·7	28	15	3·2
February ...	41·72	46·58	36·32	70·9	23·0	23	13	3·4
March ...	38·30	42·98	34·34	72·6	22·0	26	16	5·8
April ...	32·90	37·40	29·12	77·3	22·6	25	23	3·2
May	31·64	35·96	26·78	—	21·0	27	25	0·6
June ...	26·78	31·10	22·64	75·9	18·7	25	23	2·1
July	27·86	32·18	22·64	72·6	23·3	25	21	1·4
August ...	34·16	39·38	28·76	72·3	27·6	27	18	3·9
Year ...	34·52	39·25	29·87	—	22·2	301	22·2	38·9

The large mass of rain and snow is not very equably distributed; especially remarkable are the months of March and May. The winter is comparatively dry, but as a rule only snow falls and covers the country with a thick layer.* The spring has the greatest quantity of rain or snow. The hydro-meteorological conditions thus do not put any obstacle in the way of an arboracious, even an evergreen, vegetation; but still there is neither tree nor bush. Certainly there is not much lowland to bear a forest, but there is enough. The other climatological factors explain the condition. We have to do with very low summer temperatures, not seldom below freezing, and with gales of great strength, which suddenly with impetuosity break down from the glaciers over the completely exposed ground.

The paucity in phanerogamic species seems to me inexplicable. The few that exist are, as far as we now know, identical with Fuegian and Falklandian plants, and surely more species of those floras should be able to endure the South Georgian climate. The problem gets more difficult still when we think of the numerous cryptogamic species, amongst which a great percentage is endemic. The story of the geographical development and the former large extension of the inland ice will perhaps give an answer to the question.

As I stated already in the beginning of this paper, geographers regard South

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* Skottsberg, 'The Geographical Distribution of Vegetation in South Georgia,' *Geographical Journal*, November, 1902 (London: 1902).

Georgia as a real Antarctic land; I also said that this, from a botanical (phytogeographical) point of view, is not my opinion. The vegetation is nearly related to that of the Falkland islands; the lowland is covered by the Austral steppe, and the tussock grass *Poa cæspitosa* (Forst.), Hook. fil., plays the same part as once in the Falkland islands. An important difference between the two floras is that *Empetrum rubrum*, Vahl., one of the most characteristic Falkland plants, does not grow in South Georgia. When my collections are determined, I hope that we shall be a little better informed on the phytogeographical position of that island. Very likely some of the endemic mosses will prove to be identical with others described from other South Atlantic lands.

The *South Sandwich Islands* have never been visited by scientists, and we know nothing about their phytogeographical position. But I conclude that they are nearly related to South Georgia, though perhaps still poorer; their vegetable life perhaps forms a still more apparent transition to the Antarctic.

The Antarctic Zone.—The Antarctic lands, here referred to, are—Graham Land with its subdivisions[*] (King Oscar II. Land, Palmer Land, Louis Philippe Land, Danco Land) and surrounding groups of islands (Dirk Gherritz Archipelago, Trinity island, Joinville, and Dundee islands, etc.), and the South Shetland islands, the Elephant islands and the South Orkney islands.

The Antarctic zone may be called a cold-desert zone. The climate does not admit the existence of a close vegetation of forest or even grass, not because of an especially low winter temperature, but because the summer is very cold, the ground being frozen almost all the year; further, the wind is really formidable. On the coasts of the main land we cannot hope to make richer finds, because of the inland ice, that covers the land down to the sea-level, steep rocks being very often the only spots of bare ground. But all the small islets are free from ice, and, in summer, from snow too, and there we have to look for the richest Antarctic flora. I have not seen very much of the South Shetlands, but in one location (Harmony Cove, Nelson Island) I made acquaintance with one of the most dense and fine-looking moss carpets I ever saw down there. The islets at the west coast of Louis Philippe Land and in the Gerlache Strait are also in possession of a relatively rich flora, but here

Snow Hill Island, Lat. 64° 24′ S., Long. 57° 6′ W. 1902–03.

Month.	Mean temperature. Fahr.	Means of max. temperature. Fahr.	Means of min. temperature. Fahr.	Mean strength of wind. Ft. per sec.	Days with snow or rain.
	°	°	°		
March	13·28	18·50	7·88	36·15	29
April	7·16	15·08	−0·22	24·93	25
May	−0·76	7·70	−8·68	28·22	27
June	−3·46	1·22	−16·96	28·22	21
July	−5·62	3·38	−13·90	31·17	27
August	−2·92	8·78	−13·00	28·87	20
September	3·74	12·20	−4·18	25·59	20
October	15·08	23·00	6·80	24·93	23
November	17·42	21·74	12·92	24·61	26
December	28·40	32·90	23·36	13·20	15
January	30·38	34·16	27·14	19·69	22
February	25·70	33·80	20·84	22·97	22
Year	10·70	17·70	3·50	25·76	277

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[*] In "Antarctic" (Stockholm, 1904) Mr. Nordenskjöld has proposed the name "West Antarctic" for these parts of the south polar lands.

of course, as in all Antarctic lands, the phanerogamic plants play no part in the general aspect presented by the vegetation; it is not many places where the only Antarctic phanerogamic, *Deschampsia antarctica*, Hook., is found, and very sparely indeed. And, generally, the mosses and lichens do not form a compact, close carpet, but grow in small tufts in the fissures or between the stones.

The penguins are perhaps one of the most inimical influences of Antarctic plants. On many places where the Antarctic flora might have attained a rich development, we find the ground completely covered by penguin rookeries, not leaving as much as a square inch free from guano. A striking example of the influence of the penguin rookeries is Paulet island. There all the level ground, all the slopes, when not too steep, are quite covered with penguins. The vegetation has been forced to withdraw to the upper plateaus round the top of the island. That leads me to think of a statement, made without any reason, that the vertical limit of Antarctic vegetation is to be drawn at 100 feet above the sea-level.* On the top of Paulet island, at a height of 1200 feet, we still find spots of mosses and lichens encrusting the stones.

As to the relations between Antarctic plants and other plants of the world, we know very little. The musci collected by Mr. Racovitsa during the Belgian expedition were twenty-seven, of which fifteen were new species.† The others are more or less identical with species found on the northern hemisphere; some exist in the Magellan territories too. One species is found only in South Georgia and in the Antarctic. The hepaticæ, three kinds, are remarkable because two of them were described from South Georgia before.‡

For many years there has been a special interest in the question of bipolarity. A superficial glance at my Antarctic collections shows great concordance with northern and arctic plants, but it has to be proved that we have to do with real bipolar or merely with cosmopolitan species.

YEARLY MEAN TEMPERATURE AND RAIN (SNOW, HAIL, ETC.).

	Temperature. Fahr.	Rainfall. Inches.
	°	
Tierra del Fuego, Orange bay ...	41·99	53·50
Isla de los Estados	42·30	59·10
Tierra del Fuego, Ushuaia	43·63	26·38
Patagonia, Puerto Gallegos	45·37	8·23
Falkland Islands	42·98	20·36
South Georgia	34·52	38·89

II. THE VEGETATION OF THE OCEAN.

As to the flora of the South Atlantic ocean, also here we, in my opinion, find the same limit between Austral and Antarctic vegetation.

The *Austral flora* is characterized by the existence of types of algæ with, in one way or another, floating fronds. *Macrocystis pyrifera* (Turn.), Ag., and *Durvillea utilis*, Bory., are the most representative Austral algæ. The *Macrocystis* surrounds the coasts of Tierra del Fuego, the Falkland islands, and South Georgia.* It would be interesting to know if it also lives round the South Sandwich islands. I do not know if the Scottish South Polar Expedition has found the *Macrocystis* in the South Orkneys, but I should think not.† Other characteristic algæ are the Lessonias.

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* A. Ohlin, "Om antarktiska färder och Antarktis," *Ymer*. Stockholm: 1898.

† Y. Cardot, 'Mousses' ('Résultats du voyage de S.Y. *Belgia*,' Anvers, 1903).

‡ F. Stephani, 'Hépatiques' ('Résultats du voyage de S.Y. *Belgia*,' Anvers, 1903).

The *Antarctic vegetation* is characterized by the total absence of a type with floating fronds (except the *Marginaria jaquinoti* (Mont.), floating when torn off from the bottom). Such a type would be quite inconsistent with the ice-conditions. The vegetation of the beach is influenced in its character by the ice-floes always grinding against the stones, and has been forced to retire into the small basins, where the ice-floes cannot come. Giant algæ are not at all wanting, especially the *Desmarestiæ*, but in a greater depth. Here, as in more northern shores, calcareous algæ form an important part of the vegetation.

The extension of the Austral and Antarctic zones into the Indian and Pacific oceans has not been referred to here. As botanically Antarctic lands we perhaps ought to consider Enderby and Kemp Land, the different parts of Wilkes Land, Victoria Land with Balleny islands, and Alexander Land with the Biscoe islands. Austral lands are Bouvet island, Prince Edward and Crozot islands, Kerguelen, MacDonald and Heard islands, New Zealand and Antipode, Chatham, Auckland, Campbell, Macquarie, and Emerald islands.

The northern limit of Austral vegetation seems to me difficult to define. I think that the 40° S., of course with some deviations to the north or south, more or less limits it. To this question, as well as to the circumpolar extension of Austral vegetation, I shall return another time.

GRUEBER AND DORVILLE'S JOURNEY ACROSS TIBET.

To the Berlin *Zeitschrift der Gesellschaft für Erdkunde* for 1904, No. 5, Herr R. Tronnier contributes a monograph on the journey made in 1661 across Tibet by the Jesuits, Johannes Grueber and Albert de Dorville. Subjoined is a summary of the results.

The object of the present study is to vindicate for the German, Johannes Grueber, the place to which he seems entitled in the history of geographical progress, but which has certainly not hitherto been conceded to him. He is certainly not the first European that crossed Tibet, as Odorico de Pordenone's journey shortly before 1330 can scarcely be called in doubt. But he is the first who brought back with him a genuine record of the land and its people. Although a Jesuit, he did not go to Lhasa as a missionary like his precursor and his immediate successors; he went on a real geographical mission, imposed by the necessity of finding a new home route to Europe, a route which at the time was supposed to be still untrodden.

Authentic documents referring to the journey are not very numerous. They comprise five of Grueber's letters, a Latin report of the Jesuit, Athanasius Kircher, and lastly a long Italian "Relazione" by an uncertain author. The chief difficulty in reconstructing the journey lies in the fact that these scanty materials present great discrepancies, to reconcile which, where at all possible, is the purpose of this essay.

Grueber's Letters.—I. The earliest extant, dated from Surat (India), March 7,

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* Skottsberg, "Några ord om Macrocystis pyrifera," *Bot. Notiser*, 1903, No. 2.

† Since this was written, I learn that the Scottish Expedition has reported three mosses, six lichens, and some algæ from the South Orkneys, but *not Macrocystis*.

1658, is written in German, and addressed to the Rev. Father John Haffenecker, rector of the Jesuits' College and University of Graetz in Styria.

II. The second, which, like all the rest, is in Latin, follows a now lost short communication to the same address, and is undated, but was sent to P. Joannes Gamans, S.J., in Aschaffenburg from Rome shortly before starting on his second journey, hence apparently about the beginning of 1664. It is by far the most important of all his letters on his journey through Tibet.

III. is dated May 10, 1664, from Venice to Kircher, after starting on his second journey. It contains a copy of another undated letter from P. Ferdinand Verbiest, which Grueber had received in Singanfu after his departure from Pekin (1661).

IV. and V. are replies to a distinguished acquaintance of unknown name and address, on all kind of things connected with the journey. IV. was written in Danzig on December 11, 1664; V. in Breslau on March 14, 1668.

As far as known, Letter I. occurs first in the collection 'Der Neue Welt-Bott' (Augsburg and Graetz, 1726), No. 34; II., IV., V. in Thévenot's 'Divers Voyages Curieux,' but apparently not in all editions. III. is found in Kircher's 'China Illustrata' (Amsterdam, 1667), pp. 222 *sq.*

'Illustrata,' pars. ii., cap. iii. § 2, and cap. iv. (pp. 64-77). Here is also given a "Carta Geodoborica," a route-map, which, however, presents a very confused picture of the line of march.

The Italian Relazione.—The origin of this document will be explained in our biographical notice, and here it will suffice to give the main result. Grueber's interview with the two Italians took place in Florence on January 30, 1666 (New Style). It is scarcely surprising that errors should occur in a narrative written down after a conversation of several hours' duration; hence it can only be accepted with a certain reserve.

The Relazione was first printed by Thévenot (*op. cit.*) as the 'Viaggio del P. Giovanni Grueber tornando per terra da China in Europa.'

For the lives of both travellers two documents have been brought to light, which, though short, are authentic. (1) Ph. Couplet, 'Catalogus Patrum Soc. Jes.' (1686), where reference is made to both under Nos. 74 (p. 39) and 81 (p. 43); (2) On Grueber alone valuable information is supplied by Carlos Sommervogel in 'Bibliothèque de la Compagnie de Jésus' (Première Partie: "Bibliographie"), (Brussels, Paris, 1892, vol. iii.).

Albert de Dorville (*ob.* 1662).—This is undoubtedly his correct name, although called Alb. de Bonville by Grueber in his Letter II. It occurs at least seven times in Kircher's 'China Illustrata,' and also in the 'Catalogus.' He was born in Belgium (date of birth unknown), and went in 1657 to China, where he laboured as a missionary in Shansi. Grueber mentions him (Letter II.) as former associate of P. Martinus Martini, procurator of the order in China and editor of the 'Novus Atlas Sinensis' (1655). In 1661 he was sent back to Europe with Grueber, but next year succumbed to the hardships of the journey in Agra.

Johannes Grueber (1623-1684).—This is the generally current form, though the 'Catalogus' write Greuber (for Grüber?), while the Latin is Gruberus. He was an Austrian-German, born at Linz, on the Danube, October 28, 1623, and received into the order October 13, 1641; went to China as a missionary in 1656, the route followed being from Rome through Asia Minor, Armenia, Persia, and Ormuz to Surat, where he stayed at least ten months, and in December, 1657, observed a lunar eclipse with a view to fixing a longitude (Letter III.). According to Letter I., he intended in a few days (counting from March 7, 1658) to sail in an English vessel for Macao, but, owing to local troubles, did not reach China till 1659.

From Macao Grueber was summoned as mathematical assistant to the court of

Pekin, where he held this position for two years (1659–1661). After the death (February, 1661) of the emperor Shunchi, first of the Manchu dynasty, Grueber was recalled "to receive instructions from the General of the Order at Rome" (Markham), de Dorville being chosen to accompany him on the return journey. As Macao was just then being blockaded by the Dutch, the two Jesuits were instructed to discover, if possible, some shorter overland route to Europe, such as was supposed at that time to have never yet been opened. The travellers now left Pekin for Singanfu and Siningfu, whence they made their way through Lhasa to Agra. Here Grueber lost his fellow-traveller (see above), but continued the homeward journey with Henricus Roth, who had been stationed for nine years in Delhi. According to the Relazione, he went from Agra in seven days to Teli (Delhi), thence in fourteen days to Lahore, and thence to Multan, where he embarked, and in forty days reached Tata at the head of the Indus delta, where he met many English and Dutch traders. After a short delay, he continued the journey by land through Maccaran (Mekran) and Cape Caramania (Kirman) to Cape Jax (Jask) and Ormuz. From Ormuz he again followed the main highway to Smyrna, where he took ship for Messina and Rome. Here he handed his memoranda to Kircher for publication, on the condition that everything was to be included in one volume.

Soon after Grueber was ordered to return to China, and on May 10, 1664, he was already in Venice (Letter III.), evidently on his way to Vienna, as this time he was to take the overland route through Russia to China. After writing Letter IV. (December 11, 1664) at Danzig, he went to Mitau, near Riga, the court of the Duke of Courland, who informed him that news had just come in from the Grand Duke of Moscow that the road to Astrakhan was blocked by the Tatars, at that time allies of Poland against Russia (Letter V.). Grueber had therefore to give up his project, and returned through Breslau to Vienna, whence he accompanied the emperor's envoy, Count Lesle (Lesly) to Constantinople, with the intention of again striking the old overland route eastwards. But here he suddenly fell ill, and, being unable to continue his journey, returned by sea to Leghorn for Florence. Here he had a long interview with Carlo Dati and the author of the Italian Relazione on January 30, 1666, New Style, which answers within a day to the "31 Gennajo 1665 al Incarnatione," the date borne by this document.

Little more is known of the life of Grueber. At the time of the interview he was still under orders to return to China, but does not appear to have done so. Markham states that "Grueber died in 1665 on his way back to China," that is, 1665 Old Style = 1666, as above seen. But even so this date cannot be accepted, and credence must be given to the statement of the 'Catalogus' that Grueber died in 1684, not on his way East, but in Germany.

ACROSS TIBET.

From Pekin to Sining.—Our travellers left Pekin on April 13, 1661, as stated by Grueber in Letter II.: "Discessi è Sinis Pequino 13 Aprilis 1661." Kircher writes in his barbarous Latin, "Ex Pequino itaque hi Patres anno 1661, mense Junio, in Siganfu triginta dierum et hinc Sining sive Sininfu, totidem fere dierum decursu transacto bis croceo flumine, quod Hoang vocant, transito, confecerunt iter." Hence Astley's "he left Peking in the month of June," referring "mense Junio" to "ex Pequino" instead of to "confecerunt iter." All agree that Singan was reached in thirty days, and Sining in another thirty days, so that the section of the journey in China proper took altogether two months. In Singan they probably stopped a few days, since here Grueber received the above-mentioned letter from P. Verbiest, which, as shown by the contents, was written at the earliest four or five days after the travellers had left Pekin; cf. also the address:

"Ad Gruberum in Singanfu *commorantem*." In Sining, again, they must have waited some time for a suitable caravan; hence the somewhat full description of this important mart and its surroundings, with the determination of its latitude, although the reference to the Great Wall is not very clear. According to Peschel and Markham, the stay in both cities should be estimated altogether at one month. For the whole journey from Pekin to Lhasa they allow six months, of which two, as seen, from Pekin to Sining, and three, as we shall see, from Sining to Lhasa, leaving one for the delays in China proper. But this six months is nowhere clearly given, and unless it be a simple error it may have been arrived at on the following calculation. Kircher gives, as the duration of the whole journey from Pekin to Agra, fourteen months; and Grueber (Letter III.) eleven months "after leaving China." Thus the Chinese section would be 14 − 11 = 3 months, that is, the two *en route* and the one of detention, as above.

From Sining to Lhasa.—With Sining begins the most interesting, but at the same time, for us, the least-known section of the journey. From this place to Lhasa there are two main routes. One, the "old" highway, as it is called on Sven Hedin's large map (*Petermanns Mitt. Supplement*, 131, 1900), leads from Sining south-westwards straight to the large lacustrine sources of the Hoang-ho, crosses the Di-chu at Tatsando, and south of the Tanla range joins the other route. This second road runs from Sining west to the Kuku-Nor, skirts it north and south, crosses the south Kuku-Nor range, and traverses the Tsaidam plain to Dsun-Sassak. Here it ramifies, one branch immediately surmounting the ranges in a south-west direction, the other trending first westwards along their foot, and then bending southwards. At the confluence of the Napchitai-ulan-muren with the Murussu (Di-chu) the east branch again ramifies; one line, crossing the headwaters of the river, amongst them the Toktonai-ulan-muren, joins the west route, while the other at once crosses the Murussu and continues to run east of the river. Both branches again unite south of the Tanla range, and then follow the same track as the first route all the way to Lhasa.

In order the better to understand which of these routes was actually taken, here are juxtaposed the pertinent passages from the extant documents—

Grueber (Letter II.).	Kircher ("China Illustrata").	The Ital. Relazione.
". . . Indo (Sining) egressus transivi trium mensium spatio Tartariam adeo desertam . . . Tertio mense attigimus regnum Baranateka. . . ."	P. 65.—"A Sining trimestri spatio per Kalmack Tartariæ desertam, usque ad initium Regni Lassa quod et Barantola Tartari vocant, pervenerunt. . . . P. 67.—Egressi itaque hanc stupendi muri vastitatem dicti Patres, statim rivum piscibus refertum obviam invenerunt . . . transito quoque flumine croceo (Hoang) extra muros, statim vastissimum illud desertum Kalmack . . . ingressi, ad Barantolæ Regnum usque trimestri spatio confecerunt. . . ."	P. 2.—"Essendo egli di China entrato nelle arene della Tartaria deserta, e quella attraversata in tre giorni arrivatò alle spiagge di Kokónor. Questo è un mare simile al Caspio di donde ha l'origine il fiume Giallo . . . Kokonor dunque significa in lingua Tartara Mar grande, dalle rive del quale successivamente discostandosi il Padre entrò in terra Toktokai . . . Per questa terra passa il fiume Toktokai da cui prende il nome; bellissimo fiume e sull' andare del Danubio, se non che ha pochissimo fondo, e un' uomo a cavallo lo passa francamente a guado. . . . Quindi inoltratosi nel paese di Tangut arrivò in Retink, provincia assai popolata del Regno di Barantola, e finalmente nel Regno detto propriamente Barantola. . . ."

A comparison of these records shows clearly that the section between Sining and Lhasa took about three months. This of itself may be important when taken in connection with the following passage from P. Desideri (Lhasa, 1716–22), which occurs in the *Nouveau Journal Asiatique* (Paris, 1831), vol. viii. p. 130: "De Lhasa à Sining il y a deux routes. L'une, de 4 mois, passe par des pays inhabités; l'autre par le désert, n'est que de 3 mois; elle est plus à l'ouest et au nord, et coupe le désert en droiture." This, of course, cannot be taken absolutely, since the caravans move at very different rates of speed. Still, the statement gives us a first safe standpoint. But Grueber says too little, while Kircher tells us that just beyond the "wall" they came upon a river abounding in fish, and also beyond the "wall" crossed the Hoang to enter the "Kalmack desert" (?), statements which are duly entered on his hopelessly confused "route-map," but must remain unintelligible to us. The alleged second crossing of the Hoang-ho can fit in with the "old" route only by taking "extra muros" in a very wide sense, and placing the crossing somewhere between the Oring and the Charing-nor. But this would again be scarcely admissible, since the "Kalmack desert" is not entered till after that crossing.

In the much fuller Relazione, the travellers, after leaving China, traversed the Tartar desert to the Kuku-nor in three days. Then they reached Barantola (Lhasa) through the Toktokai district and the province of Retink, the Relazione here giving relatively ample descriptions, for instance, of the Kuku-nor and of the Koktokai river. Why did Grueber and his editor Kircher pass these things over in silence? But, as such details cannot have dropped from the clouds, we must still assume that they were obtained by the author of the Relazione from Grueber. Only then three points will have to be rectified: (1) Kuku-nor does not mean the "Great," but the "Blue," lake; (2) it cannot be compared with the Caspian, which is about a hundred times larger; (3) nor is it the source of the "Fiume Giallo" (Hoang-ho). Although these statements are wrong, they still show that Grueber was aware that the river trended a long way to the west from Lanchau. Nor will any one infer anything in favour of the "old" route from his statement regarding a "lacustrine source" of the Hoang-ho. On the other hand, it may presumably be inferred that Grueber skirted the Kuku-nor, not on the south side, where, according to Stieler's latest map, the main highway runs, but on the north side, and had thus no opportunity of correcting his mistake regarding the Hoang-ho. And Prjevalski tells that caravans even still take the north side of the lake (*Petermanns Mitt.*, 1876, p. 167).

All this points to the western as the more probable route, and it may even be inferred that the "old" road was already at that time little used. Our travellers' itinerary would thus coincide here with that of Huc and Gabet (1845–46), who also followed the north side of Kuku-nor. Then the further section as far as Dsun-sassak can be anticipated, and, indeed, is laid down on the maps. But at Dsun-sassak fresh difficulties arise, as here begins the above-mentioned forking.

According to the Relazione—the other records are silent—the travellers now entered the Toktokai district, supposed to be so named from the Toktokai river. Where is this district to be sought? Markham and von Richthofen point out that one of the headwaters or left tributaries of the upper Yangtse (Murussu) is the Toktonai-ulan-muren, which might perhaps be brought into this connection. It was above seen that this river is crossed by one caravan route west of the Murussu. But, however tempting the conjecture, it cannot be accepted. According to Prjevalski (quoted by St. Martin *s.v.* Yangtse), the Toktonai-ulan-muren is only 20 to 30 metres wide at its junction with the Murussu, which is here 60 to 80 metres wide, but fordable. On the other hand, Grueber's Toktokai is spoken of as a very fine river, broad as the Danube, although (at that season) easily fordable on horseback. Von Richthofen rightly assumes that the breadth here meant is that of the Danube at Linz, Grueber's birthplace, where the bridge is about 200 metres long—that is, ten times that of the Toktonai. Nor does one quite see why a large province should be called after a small river, or why Grueber should not have mentioned the more northerly and much more important Napchitai-ulan-muren, or the central mainstream (Murussu) itself. That this last was really meant seems almost certain from these and further considerations. The pundit A. K. once gives the alternative name "Thokto" to the upper Murussu (*Petermanns Mitt.*, 1885, plate i.), while Grueber's statement as to the breadth of the river agrees remarkably well with that given by Prjevalski for the Murussu (Di-chu) at the Napchitai-ulan-muren confluence—that is, just where it is crossed by the main easterly track (the 1873 journey). At this point Sven Hedin's map (see above) describes it thus: Main branch 214 metres, breadth of the river-bed (of course, at summer high water) about 1600 metres. But as the stream was easily fordable on horseback, and its breadth was that of Prjevalski's smaller figure, it follows that our travellers reached the river at a time when the summer high water (June to July) was already over, while in any case its great breadth did not permit of any great depth.

Equally strong reasons for the westerly track it would be impossible to adduce from the scanty extant records. The very rough passes over the Burkhanbudda, Shuga, and Bayan-Khara-ula ranges, leading to where the Murussu was certainly forded (see above), could just as well have been surmounted by our travellers as they were later by Huc and Gabet and Prjevalski. Beyond the Murussu, where, owing to the severe climate, the caravans begin to break up into small scattered groups, the wayfarer traverses the broad plateau about midway between the river and the "old" route, and thus gains the Tanla range, and beyond it the converging point (Nap-chu) of all the roads leading south.

The Relazione brings the travellers from the Toktokai district through Tangut to the thickly peopled province of Retink. The term "Tangut" is usually restricted to the Kuku-nor region; that is, the north-east corner of Tibet. Hence Markham supposes that in this instance it has been extended to the tableland north of Lhasa. Kircher even applies the name to the whole of east Tibet, Barantola included. Perhaps it might be equally correct simply to reverse the sequence of the two names Toktokai and Tangut.

In Lhasa.—For the capital of Tibet, Grueber uses both the native name Lhasa and the Tatar (Mongol) Barantola. As this was the terminus of the caravan with which they had hitherto travelled, they had now to look round for another destined for India. It is not quite clear how long this took them, as Grueber speaks only of a month ("in hac civitate sumus morati uno mense," Letter II.), while Kircher and Markham give them two months. Perhaps the *one* and the *two* are to be taken as round numbers.

Grueber utilized the delay to fix the latitude of Lhasa, and take sketches of the natives, the temples, and the "Burg Bietala" (Kircher, 74), residence of the Dalai Lama [Pota-la].

From Lhasa to Agra.—Four days out from Lhasa our travellers reached the very high "Langur" range, which Kircher wrongly connects with the Paropamisus of the ancients, and with Marco Polo's Bolar. Crossing this terrible range, where they could hardly breathe from the rarefied atmosphere, and were in constant danger of being poisoned by the effluvia of certain plants, they still took nearly a month to reach Cut(h)i, the first city in "Necbal" (Nepal). In Stieler's old atlas the name "Langur" certainly occurs, only the range is placed too far from

Lhasa to be reached in four days. The pundit of 1867 tells us (*Petermanns Mitt.*, 1875, 150) that the people of Nepal call all snowy peaks Langur, and it is evident from all the circumstances that here Langur simply means the Himalayas. They therefore followed the great highway, which leads from Katmandu to Shigatse, on the upper Brahmaputra (Sanpo), and has often been described. From Kuti they went by one of the most difficult roads in the world (Markham) to Nesti in five days, and thence in six days to the double capital of Nepal, Katmandu-Pattan. Here they had a friendly welcome from the king, whom Grueber greatly astonished with the wonders of a little telescope which he gave him.

From Nepal five days (Kircher) took them to Hedonda, a station of the Moranga state, which state they traversed in five days, meeting no towns, but only straw huts and a royal custom-house. From Hedonda Kircher brings them in eight days to Mutgari (Markham's Motihari), the first city of the Moghul, and thence in ten days to Battana (Patna), on the Ganges, crossing the river at Minapor (Markham's Dinapur). Thence eight days brought them to Benares, eleven to Ca(ta)mpur, and seven to Agra, where de Dorville died (see above). This place was reached about the middle of March, 1662, and as the start was made on April 13, 1661 (see above), the whole journey between Pekin and Agra lasted just about eleven months, as stated by Grueber in Letter II.

Astronomic Observations.—Of special interest to geographers, are the somewhat numerous determinations of latitude which were made by Grueber *en route*. Although pretty accurate, it will be seen, from the comparative figures given below, that all his determinations, owing perhaps to defective instruments, are too low by from 24′ to 53′, or say, roughly, by a mean of half a degree.

Place.	Latitude (Grueber).	Later determinations.
Sining	36° 10′	36° 39′ 20″ (Jesuits, 1708–9 ?). 36° 33′ 32″ (St. Martin; Easton, 1880). 36° 37′ 15″ (Potanin, 1884–6).
Lhasa	29° 6′	29° 39′ 17″ (Pundit; St. Martin).
Katmandu	27° 5′	27° 41′ 28″ (Pundit). 27° 36′ (St. Martin).
Hedonda	26° 36′	27° 26′ (Pundit).
Patna	24° 44′	25° 35′ (Indian Survey). 25° 37′ 15″ (St. Martin).
Benares	24° 50′	25° 17′. 25° 18′ 33″ (Observatory).

Here follow the latitude and longitude (E. of Rome), partly calculated by P. Henricus Busaeus from Letter III. before Grueber's own observations.

Place.	Latitude.	Long. E. of Rome.	Long. E. of Paris (St. Martin).
Agra	26° 43′	—	75° 41′ 29″
Delhi	28° 39′	$4^h\ 16^m\ 16^s = 64° 4′$	74° 52′ 8″
Surat	21° 10′	Lost.	—

According to Grueber-Busaeus, the longitude east of Greenwich would be for Agra 76° 34′, instead of 78° 2′ (St. Martin); for Delhi, 76° 54′, instead of 77° 12′ (St. Martin). All these data, published but not utilized by Kircher, were studied by later European cartographers, amongst others, G. de l'Isle and Nolin for their maps of Asia (Paris, 1700 and 1704).

On other materials supplied by Grueber, Astley wrote about 1745, "With regard to the Chinese and Tarters, Grueber has explained some things more fully than other authors have done, as well as related others in a different manner." His ethnological descriptions and sketches of Tartars (Mongols) and Tibetans agree fairly well with those of K. Futterer and other recent observers. His actual wanderings may be roughly estimated at a total length of some 25,000 miles, or about the circumference of the globe.

VAN DER GRINTEN'S PROJECTION.

By E. A. REEVES.

There can be no doubt that for certain purposes it is an advantage to represent the whole surface of the Earth on one plane instead of by two hemispheres. The geographical distribution of population, oceanic circulation, isothermal and isobaric lines, and other natural phenomena, can, as a rule, be much better shown on some such projection; and certainly steamer tracks, telegraph cables, etc., can be followed far more readily when laid down upon a map of the whole Earth than when shown on a projection that necessitates the breaking up of the lines into sections. The drawback to all such projections, however, is the necessary great distortion, either in the area or configuration of the land, in high latitudes. The two projections of this kind which are most familiar, and which can be seen in many atlases, are the well-known Mercator's projection, and the Elliptical Equivalent projection invented by Prof. C. B. Mollweide in 1805. Whilst the former is admirably adapted for marine charts, its enormous exaggeration of the land areas in high latitudes renders it unsuited for most other purposes. In this the angles of intersection between the parallels and meridians, and the general configuration of the land, are preserved at the expense of greatly exaggerated areas and distances as the equator is left. To obviate these defects Prof. Mollweide drew his elliptical projection; but in preserving the correct relation between the areas he was compelled to sacrifice configuration and angular measurement, as will be seen by a glance at Fig. 4.

A projection has recently been constructed and patented by Mr. Alphons J. van der Grinten, of Chicago, of which the object is to strike a mean between the projections of Mercator and Mollweide, and a full description of this is given in *Petermanns Geographische Mitteilungen* for July last. Figs. 1 and 2 give a general idea of this projection and its construction. The parallels of latitude and meridians are contained in a circle, or marginal meridian, the area of which is equal to the surface of a globe of half the diameter. The straight line representing the equator, instead of being divided into 180°, as in ordinary circular projections, is divided into 360°, so as to include the whole equatorial circumference of the Earth; thus, instead of there being 90° on either side of the central meridian, there are 180°. In order to obtain the average general distribution of errors of area and angle to the best advantage, the parallels of latitude increase rapidly soon after leaving the equator, and the points where each of these intersects the central meridian and that forming the circumference of the map or plane of projection is obtained by the formulæ—

$$d = \frac{\sqrt{1+c} - \sqrt{1-c}}{\sqrt{1+c} + \sqrt{1-c}}; \; y = \frac{c}{2-c}$$

where d represents the distance of any parallel from the equator on the central meridian; y the distance of the same from the equator on the marginal meridian or circumference; and c the ratio of any latitude to 90°.

The geometrical construction of the projection is extremely simple, as will be seen by Fig. 1, and it is in its favour that no special tables are required. Any map-draughtsman could construct a map of the world on this projection without difficulty in a very short time.

A comparison of the outline map of the world drawn on Mr. Van der Grinten's projection (Fig. 2) with those drawn on Mercator's and Mollweide's projections (Figs. 3 and 4) will give a good general idea of the relative merits and defects, and, taking all things into consideration, there can be little doubt that Mr. Van der Grinten's projection possesses advantages over the others for special purposes, such as representing the geographical distribution of natural phenomena, oceanic circulation, trade routes, etc. For educational purposes it could hardly be recommended any more than the others referred to, and, indeed, in some respects it would be more likely to mislead the pupil, especially as it is circular in form and has the appearance of being a perspective projection. The apparent great distance of the poles from the continental land masses would be sure to lead to confusion. To obviate this to some extent, it is suggested by the author that for ordinary purposes the exaggerated northern and southern polar regions could be cut off, thus giving a map somewhat the appearance of Mercator's, while at the same time possessing the advantage of conveying a far more accurate idea of relative areas Even in this projection, however, the exaggeration in northern and southern

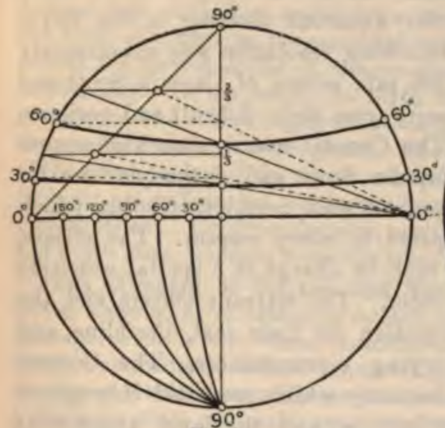
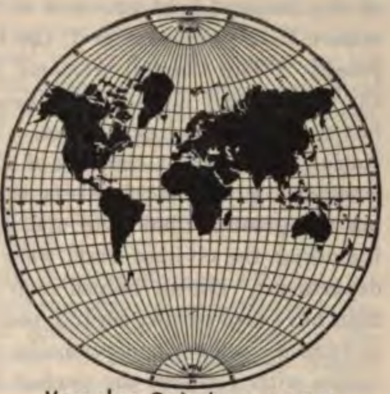
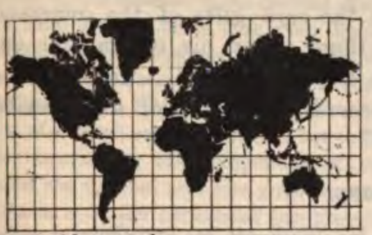


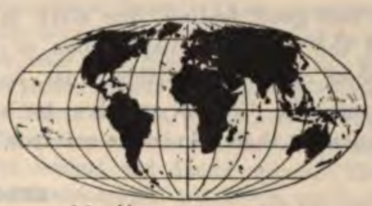
Fig I



Van der Grinten 1898
Fig 2



Mercator 1569
Fig 3



Mollweide 1805
Fig 4

latitudes is considerable, and it is, indeed, impossible that it should be otherwise when it is remembered that the distance between the poles is shown on the map as exactly the same as the whole circumference of the globe at the equator.

THE MONTHLY RECORD.

THE SOCIETY.

Tribute to the Antarctic Expedition.—At the meeting of the Council of the Society, held previous to the Antarctic meeting in the Royal Albert Hall on November 7, the following resolution was unanimously passed: "The Council welcome the safe return of Captain Scott and the officers and men of the *Discovery* from their difficult and perilous, but most successful expedition. The Council record their high appreciation of the great services of Captain Scott, and of the qualities for command which enabled him to secure such complete results, which are far greater than were anticipated in every respect. The officers, including the civilian staff, were each in charge of a special scientific department,* but all helped each other. The warrant officers and the men have also earned cordial recognition for their zeal, discipline, and endurance under exceptionally trying circumstances. The Council notice with pleasure the perfect harmony which prevailed throughout the long period of this Antarctic service, and the loyal attachment that subsisted between the officers and men and their commander. To this good feeling, due alike to the rare gifts of the commander and the excellent dispositions of those under his orders, the great success of the expedition must be mainly ascribed. To all the explorers the Council resolve to accord most cordial and heartfelt thanks for their admirable services."

EUROPE.

History of the Tyne and Wear.—Mr. Woolacott has contributed a paper to the Philosophical Society for the University of Durham, on "The Geological History of the Tyne, Wear, and Associated Streams" (*Proceedings of the University of Durham Philosophical Society*, vol. ii. part 3, 1903), in which he points out that there have probably been four cycles of river and stream development in Northumberland and Durham. The first, between the Permian and Cretaceous times, affects only the upper courses of existing rivers. The second occurred between the post-Cretaceous uplift and the glacial period. Most of the smaller streams developed during this epoch have been totally obliterated by their valleys being filled with drift during the glacial period, and also many of the larger streams have had their courses changed. The Wear, probably a dip stream throughout its course, may have been a tributary of the Tees, but was probably beheaded by a subsequent tributary of the Tyne, which had been developed along the edge of the outcrop of the Permian rocks along the line of the present Team. This would account for the Cleadon valley, which was probably further deepened by a small tributary of the Tyne before glacial times. The Tees, too, which once flowed by the valley of the Leven and the Esk to the sea, may also have been captured by a subsequent stream of the Triassic outcrop roughly parallel to that diverting the Wear along the Magnesian limestone. The third cycle began at the end of the ice age, during which many smaller valleys were obliterated, the larger ones being partly filled with drift. In many cases the streams cut through the rock rather than the boulder clay. The Wear eroded a new course from Durham to Sunderland, while the Team now flows in the pre-glacial valley over glacial deposits. The Tyne follows the general course of the pre-glacial valley, but has changed its bed considerably. To the north, the Blyth and Wansbeck and other streams are post-glacial with courses largely to the north, while the Sleekburn valley, between the streams mentioned, is pre-glacial. The fourth cycle began with the formation of the raised beaches of the district, which indicate a depression of some 150 feet, probably not uniform, but the changes brought about in this recent cycle have not been important. The denes, deep-cut, small, gorge-like valleys, between Sunderland and Castle Eden, run right across the raised beaches.

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* Armitage: navigation and magnetic observations at sea. Royds: meteorology. Barne: tidal observations. Mulock: cartography. Skelton: photography. Koettlitz: bacteriology. Wilson: vertebrate biology. Hodgson: invertebrate biology. Bernacchi: magnetism, seismology, pendulum observations. Ferrar: geology.

The Climates of Iceland and North-Western Europe.—We have received a reprint of an extremely valuable and suggestive paper published in the *Sitzungsberichte* of the Vienna Academy of Sciences by Dr. J. Hann, on the weather anomalies of Iceland during the period 1851 to 1900, and their relation to those of North-Western Europe during the same period. The paper is primarily a discussion of the remarkable series of observations made during many years by Herr O. Thorlacius at Stykkisholm, in north-western Iceland, and published in abstract in the *Journal of the Scottish Meteorological Society.* These observations have been treated more than once by Dr. Buchan in papers published in the Scottish Society's *Journal*, but Dr. Hann deals exhaustively with the full fifty years' record, and compares the results with similar records for Greenwich, Brussels, and Vienna, and for a shorter period with Punta Delgada, in the Azores. Many points of interest are brought out, but the most important conclusions are probably those revealed by the comparison of the Iceland and Azores records. These stations are situated near two great centres of atmospheric action—the one nearly on the axis of the permanent low-pressure belt of the North Atlantic, and the other in the high-pressure zone of the "horse latitudes." Dr. Hann finds that when pressure is excessive at Punta Delgada, it is in the majority of cases below the normal at Stykkisholm, and conversely, indicating a connection between the two. When the difference of pressure is greater than the normal during the winter months, the warm oceanic winds are stronger than usual, and temperature in Western and Central Europe is above the average; when the difference is less than the normal, the oceanic winds are weakened, and European temperatures are below the average. In the later sections of the paper Dr. Hann discusses the climate of Stykkisholm itself in greater detail, and compares it with that of Greenland, using the stations Angmagsalik and Godhaab. The results obtained with reference to the effects of föhn winds on the Greenland coast are of special interest. Dr. Hann's study of the problem by the application of quite general methods forms a very important addition to the more special researches of Pettersson, Meinardus, and others, and seems to bring us a step nearer to successful weather forecasting for long periods.

Old River Terraces near Vienna.—Two years ago, Dr. F. Schaffer called attention in the *Mitteilungen* of the Vienna Geographical Society to the gravel terraces which line the hills around that city, some of which had not previously been recognized as bearing that character. He has since made a further study of the subject, to which he recurs in the same publication (Nos. 3 and 4 of the present year), pointing out the interest which it possesses, not only as throwing new light on the past physical history of the region around Vienna, but from the wider point of view of past changes affecting the whole region of Central and Southern Europe and the Mediterranean. Prof. de Lamothe, to whom, among others, Dr. Schaffer pointed out the river-terraces in the neighbourhood of Vienna at the meeting of the International Geological Congress last year, and who was quite prepared to accept Dr. Schaffer's interpretation of them, has for some time been investigating similar terraces on the Rhine, Moselle, and Rhone, and in Algeria on the Isser and the Mediterranean coast. The remarkable point brought out by these researches is the marked agreement in the altitude of the successive terraces of widely separated localities, which seems to point to a connection between their modes of origin. The terraces round Vienna show the same general agreement, as do also those lately described by Savastos from the valley of the Sereth in Rumania, and thus seem to give new support to De Lamothe's conclusion, that we have here an evidence of past movements in the level of the Mediterranean, which have in turn influenced the physical history of the rivers of the adjacent continents. Dr. Schaffer hopes before long to discuss the subject in greater detail, and as Prof. de Lamothe is also continuing his investigations, the results will be awaited with much interest.

Tree and Bush Limits in the Eastern Alps.—The association for the protection of alpine plants has lately inaugurated a series of systematic observations on the altitudinal limits of the growth of trees and shrubs in the Eastern Alps, and though the data collected are not yet sufficient to allow of a complete discussion of the question, certain results have been gained, which are summarized by Karl Schmolz in the *Mitteilungen* of the German and Austrian Alpine Club (1904, No. 13). When the scheme was first set on foot by the association, great numbers of applications were made for the schedules which had been prepared in order to facilitate the recording of the data on a uniform plan, but comparatively few have been returned filled up. Thanks, however, to the enthusiasm of a few observers, 1018 determinations of altitude had down to last year been effected, and these cover the greater part of the Eastern Alps. In summarizing the results in tabular form, the writer gives the upper limit of growth in the case of three trees, the spruce fir, the larch, and the cembra pine ("zirbe"), distinguishing also the altitudes attained in the north and south of the range (the parallel of 47° being taken as the dividing line) and according to the aspect of the slopes. In the case of brushwood (juniper, dwarf willows, green alder, etc.), both the upper and lower limits are given. Of the three trees mentioned, the cembra pine reaches the greatest altitude, the average upper limit lying at 6526 feet, while single specimens reach 6775 feet. The mean for the three trees is 6129 feet, and the difference between the altitudes reached in the north and south of the range averages about 505 feet (the higher figure naturally referring to the south). As regards aspect, the slopes facing west give the highest figure in the case of all three trees, the northerly slopes coming next (on a general average), the southerly third, and the easterly last. The facts in regard to the smaller growths are more complicated and cannot be briefly summarized, but it may be mentioned that the means, for four kinds of bushes, of the average lower and upper limits of growth are 4934 and 6358 feet respectively. The difference between the northern and southern parts of the range does not appear to be so marked as in the case of the trees.

Distribution of Mean Height in Switzerland.—From various points of view, the influence on physical-geographical conditions of the mean elevation of a district is of more importance than that of its extreme elevation. Thus it has been shown that in Switzerland both the limit of tree-growth and the snow-line occur at a higher level where the general or mean elevation is a high one, than it does where the general elevation over an equal area is less, even though the extreme heights may be greater. A recent study of the distribution of mean elevation in Switzerland, carried out with much care by Dr. Liez, a pupil of Prof. E. Brückner, is therefore of considerable interest (*Jahresbericht Geogr. Gesells. Bern*, vol. xviii. pp. 1–38). The first part of the paper is taken up with an elaborate discussion of the methods employed for the determination of mean elevation, and the influence, on the results, of the various errors which may be introduced in the course of the calculation. The second part, to which alone attention can be directed here, discusses the results as put down in a series of tables and maps which accompany the paper. Dr. Liez's method was to divide the whole of Switzerland into a large number of natural units, formed by individual mountain groups (or by lakes), the mean elevation of each of which was calculated in turn. The tables give also the figures for each group representing the extremes of altitude, the volume and area, and also the total areas included within certain fixed contours (at intervals of 200 meters), and the areas included between each successive pair of contour lines. The first map shows the subdivisions adopted, and their corresponding mean elevations; but, in order to bring out the facts with greater clearness, the author has constructed a second map, on which lines are drawn dividing up the whole country into zones, each of which is characterized throughout by a similar mean elevation.* The map brings out clearly the threefold partition of the country between the Alps, the central zone, and the Jura, the dividing-line between the two former being that representing 750 meters. Within the Alps, the zone with a mean elevation exceeding 2000 meters takes an irregular course from south-west to north-east, being pushed southwards near the two ends by the valleys of the Rhone and Rhine, and northwards in the centre by the influence of the Ticino valley and the Italian lakes. Between these points it widens out and embraces two separate areas—those culminating in Monte Rosa and the Finsteraarhorn—with mean altitudes exceeding 2800 meters, while the widest area exceeding 2250 meters is at the eastern end, in the Engadine. The Mont Blanc area does not attain a mean elevation of 2500 meters. A difference between the Alps and Jura is seen (1) in the steeper fall of the latter towards the central zone; (2) in the smaller influence here exercised by the river valleys. Dr. Liez has also calculated the mean elevation of the three main divisions (Alps, central zone, and Jura), the figures being respectively (when the bottoms, not the surfaces, of the lakes are considered), 1654·7, 570, and 743·6 meters, or 5429, 1870, and 2440 feet. He also gives curves showing the relative areas of each falling to the various zones of altitude.

Philip Apianus's Survey of Bavaria.—A very complete study of the survey of Bavaria executed in the sixteenth century by the well-known geographer Philip Apianus, has been undertaken by Dr. Max Gasser, who publishes an article on the subject in the *Mitteilungen* of the Münich Geographical Society (vol. i.

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* The exact course of the lines will, of course, depend to some extent on the arbitrary selection of the separate units, and will therefore represent the facts of distribution in a generalized way only. Thus, if valleys, rather than mountain groups, had been chosen as the units, the results would have been somewhat different. But the large number of the units is a guarantee that the results obtained are generally in accordance with definite facts.

part i.).* The survey was carried out under the orders of Duke Albrecht V. of Bavaria, and, as we know from Apianus's own statements, occupied the summer months of six years, within the interval between 1554, when the commission was first entrusted to him, and 1563, when the map was completed. The care and labour devoted to the work is forcibly described by Cellius in his funeral oration (*Tübingen*, 1589), in which we are told that during the course of the survey the whole of Bavaria was "dimensus, emensus, permensus, remensus." As to the methods employed, however, we have to fall back on a few somewhat vague statements by contemporaries, and an examination of the map itself. As already stated, this was completed in 1563, on a scale roughly corresponding to 1 : 50,000, while another on a reduced scale more fitted for practical purposes was brought out in 1568. The original map has long been lost, but a copy in forty sheets (of which thirty-six are preserved in the map collection of the Bavarian General Staff) was made by Lieut. T. H. Pusch in 1756–61; while the wood-blocks from which the smaller map of 1568 was printed are still in existence, and have permitted the taking of a series of reprints. The map was reproduced (with some alterations) by Petrus Weinerus in 1579, and again (almost in its original form) at Munich in 1651. With regard to the method adopted, the chief point to be settled is whether or no the survey was based on triangulation, as was thought by various early commentators. Dr. Gasser holds that, while there is no *a priori* reason for rejecting this idea, an examination of the map and of the statements of contemporaries shows that it is untenable. He examines carefully the technique of the map, its scale, etc., and finds that the discrepancies from the reality are too great to permit the supposition of triangulation. The description by Georg Galgemair of the surveying instrument invented by Apianus throws the best light available on the method adopted, and shows that the survey was largely based on compass bearings from elevated positions, and that it formed a remarkable combination of the method of polygons with that of intersections. The determination of distances was largely by estimation, depending in part on hearsay only, and the scale is found to differ considerably in different parts of the map. In its construction, much care was bestowed on the fixing of the geographical co-ordinates of the principal places, an extensive series of latitudes being obtained by original astronomical observations, at which Apianus was an adept. The difficulty of obtaining longitudes seems to have been surmounted by the method, explained by Gemma Frisius, of combining the difference of latitude with the direct distance between pairs of places. A comparison of the smaller with the larger map shows that, although the former naturally contains less detail, in some cases it supplies data not included in the other; the reduction, however, seems to have been effected by squaring the surface. A comparison with modern maps is of interest as indicating changes that have taken place, as, *e.g.*, in the extent of wooded areas. It shows, also, how carefully the river-system was laid down by Apianus. In conclusion, the writer expresses the opinion that the survey was the most complete, not only of the time in which it was made, but of the whole period down to the introduction of triangulation.

ASIA.

M. Gervais-Courtellemont in Western China.—Ever since the French traveller, M. Bonin, discovered some years ago the remarkable bend made by the upper Yang-tse in the neighbourhood of Li-kiang-fu, the district has exercised a considerable attraction for explorers, several of whom have since visited the locality.

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* The *Mitteilungen* form the continuation of the *Jahresberichte* hitherto issued by this society.

The latest of these is M. Gervais-Courtellemont, who last year made a journey in this region accompanied by his wife, by whom a short account of the journey has been given in the *Revue de Géographie* for September 1 of this year. It is somewhat singular that the travellers should, like some of their predecessors, have regarded the question of the bend of the Yang-tse as still presenting a geographical problem at the time of their visit, although, after the report of M. Bonin's journey had appeared, there could be no valid ground for doubting the correctness of his statement. Mme. Gervais-Courtellemont says that a controversy had arisen between French and English geographers on the subject, but the only apparent ground for this statement seems to be a remark which was made in the *Journal* when the first announcement of M. Bonin's discovery came to hand, that it was difficult to reconcile his view with the results of former work in this region. As we remarked when further details were available, and have since repeated on various occasions, the difficulty spoken of arose from the incorrect representation of the bend of the river in the preliminary sketch-map issued by the Paris Geographical Society and was completely eliminated when the more detailed account was published. Without supplying a complete survey of this part of the river, which the nature of the country would render a difficult task, M. Courtellemont has done something to permit the bend to be laid down with more precision than hitherto. Like Mr. Consul Litton, whose visit to this region was referred to in the *Journal* for June last (p. 783), the French travellers went north from Li-kiang-fu up the centre of the great bend, but, unlike Mr. Litton, kept on in this direction until the river was struck at the northern extremity of the loop. The course of the river is said to have been sighted from points of vantage at seven different places, but many of these lay at a considerable distance from the route. The journey was made under some difficulties owing to the wild and rugged nature of the mountains (the main range of which lay to the left of the route), and the snow which fell constantly, but M. Courtellemont kept up his plane-table work throughout. The river is said to flow in steep-sided cañons, having cut down its bed to a great depth through the limestone formation, but volcanic forces are called in as an explanation of the rupture of the chain to allow of the passage of its waters. Whether any evidence for this hypothesis was obtained is not stated.

Journey in Eastern Tibet.—We are informed that an American traveller, Mr. F. H. Nichols, reached Bhamo on September 12 last, after a journey in the Chinese-Tibetan borderland. He left Chungking in September, 1903, and made his way, apparently by the usual route, to Chiamdo on the upper Mekong, where he spent several months in a lamasery learning Tibetan, with a view to pushing on towards Lhasa. In this he was disappointed owing to the advance of the British expedition, and therefore went south to Tali and Bhamo.

AFRICA.

Major Powell-Cotton's New Expedition.—On November 2, Major Powell-Cotton left London for Khartum *viâ* Marseilles and Cairo. He intends to proceed up the White Nile to Lado, where he hopes to be met by a Swahili caravan from Uganda and an armed escort. Striking south from this point, the explorer will pass through the eastern side of the Great Forest, probably visiting the Semliki and the western slopes of Ruwenzori. Thence he will make his way along the country to the immediate west of the watershed of the Tanganyika and Congo systems southwards towards Katanga. Eventually Major Cotton hopes either to traverse the whole of the eastern side of the Congo Free State, reaching British territory in Nyasaland, and then proceeding to the coast, or to steer right across German territory. His objects, which are mainly zoological, are to try and increase our knowledge of the okapi, obtain specimens of the giant pig in the Great Forest, and ascertain the truth about the water-lion, said to inhabit the upper Congo waters.

Journeys in Ruanda.—An interesting account is given in *Globus* (vol. 86, Nos. 1 and 5) of journeys in the extreme west of German East Africa made in 9/ 1~~8~~02–3 by Lieut. von Parish, who went out in 1901 as an officer in the military forces of the Protectorate, and at the end of the same year received the appointment of commandant of the German post of Ishangi, on Lake Kivu. During his residence here and his subsequent journeys in Ruanda his health suffered severely, and being ordered home on this account, he died almost immediately after his arrival in Germany. His notes on his journeys, which contain vivid descriptions of this interesting corner of the German territory, as well as particulars as to the native tribes, have been prepared for publication by Baron Parish von Seftenberg, and are illustrated by instructive photographs of the country and people. The first journey led east from Lake Kivu, over the picturesque mountains which bound its trough on this side and across the valley of the Nyavarongo to Nianza, the capital of King Msinga of Ruanda, to whom he was sent on a mission in company with Captain von Beringe. The king, who has only been visited by a few Europeans, belongs, as is well known, to the race of the Watussi, the northern intruders into this region, who have here obtained the sovereign power, though in some other districts they are subject herdsmen. The king is one of the few remaining African potentates who still retain a considerable amount of barbaric power, little touched by European influence, though he has latterly shown himself well disposed to his German neighbours. He and the other Watussi are of quite gigantic stature, and have well-formed features, often quite Semitic in type. From Nianza the two officers went north, striking the Nyavarongo near where it was crossed by Von Götzen, and ascending the Mkunga, a stream of equal volume, whose valley forms a direct continuation of that of the upper Nyavarongo, which makes its sharp bend to the east just at the junction. This region is one of running streams, waterfalls, lakes, and mountains, and seems a fitting cradle for the ultimate headstreams of the Nile. The photograph of the Mkunga (merely one out of many of these headstreams), gives a striking impression of the amount of water that must be gathered from this mountain region into the Kagera. Its valley, which is described as of great beauty, was followed up to the twin lakes Ruhondo and Mwuleru, from which it issues. The latter is surrounded by high mountains, and presented a particularly imposing appearance. During this time constant views were obtained of the great Kirunga volcanoes, some of which the travellers now ascended before making their way back to Lake Kivu. During the whole journey great cold was experienced. Lieut. von Parish's second journey, made in spite of increasing ill health, led by a different route to Msinga's capital and the German mission station of Isawi. Lake Kivu was left at Bujonde, about the middle of the eastern shore, and the route was found to be a comparatively easy one, and is recommended as the best permanent line of communication between the Victoria Nyanza and Kivu. It would, however, necessitate a ferry across the Nyavarongo, which where crossed was a deep stream. Lieut. von Parish came across many of the Watwa, the so-called dwarf race of this region, who had been subjected by the Wahutu before these in turn fell under the domination of the Watussi. Though small by comparison with the Watussi, they did not seem, on the average, much inferior in stature to the Wahutu. The latter will not eat or sleep in company with them, though the Watussi have no such objection. The return march to the south end of Kivu led through a little-known country, difficult on account of the steep ascents and descents, but of the beauties of whose fern-clad slopes and primeval forests a glowing description is given.

Former Glaciation in South Africa.—The evidence for a former extensive glaciation in South Africa, which has for some years been gradually increasing, thanks to the work of the geological survey officers, as regards Cape Colony, Natal, etc., has lately been extended to the Transvaal, where Mr. E. T. Mellor has found glaciated surfaces in the district between Pretoria and Balmoral (*Trans. Geol. Soc. S. Africa*, vol. vii. part i., 1904). Mr. Mellor's observations may be summarized thus: In the district lying between the Eland's river and Balmoral, outlying patches of glacial deposits representing the lower portion of the Karroo system are of frequent occurrence. They consist (apart from some sandstones and shales) chiefly of conglomerates, presenting a general similarity to boulder-clays, although the matrix is often rather of a sandy than clayey character. The contained boulders are very miscellaneous in size and composition, but always include a preponderance of rocks occurring most abundantly or exclusively to the north of their present position. The glacial deposits were laid down upon a land surface of considerable variety, many features of which reappear with slight modification in the present landscape. Where the glacial deposits have been only recently removed, glaciated rock-surfaces are of frequent occurrence, presenting a characteristic polish and striation. The direction of the striæ (which is very constant over widely separated areas), together with the distribution of the boulders, shows that the direction of the ice-movement was from north-north-west to south-south-east. Lastly, that the ice-sheet was of very considerable magnitude is shown by the extent of the deposits and their occurrence at very various levels, as well as by the parallelism and constancy of direction of the striæ.

The Census of British South Africa.—The tabulated results of the census of the various South African colonies, carried out early in the present year, were presented to Parliament in July last as an official report (Cd. 2103). We can only refer here to the more general figures, though the tables include a large amount of detailed information as to race, sex, and age distinctions, besides giving the individual figures for the various census districts, and in some cases for the chief towns. The general totals for the respective colonies and protectorates are as follows:—

	Whites.	Coloured.	Total.
Cape Colony	580,380	1,825,172	2,405,552
Transvaal and Swaziland ...	300,225	1,053,975	1,354,200
Orange River Colony ...	143,419	241,626	385,045
Southern Rhodesia	12,623	—	—
Natal	97,109	187,582*	284,691*

The increase in the total population of Cape Colony is 57·51 per cent. since 1891, while the percentages for the white and coloured population are 53·96 and 58·68 respectively. In the Orange River Colony the percentages to total population of white and coloured respectively, which in 1890 had been 37·45 and 62·55, amounted in 1904 to 37·25 and 62·75 respectively, or a very slight relative increase of natives. The relative increase of natives since 1880 is, however, much more considerable. In Southern Rhodesia the total net increase of whites has been 1591 in the past three years. The coloured population of the Transvaal includes a small proportion (1·7 per cent. of total population) of non-native races, while in Natal the number of Indians alone reaches 100,918.

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* Exclusive of native areas.

AMERICA.

Exploration in Northern Alaska.—The most valuable addition yet made to our knowledge of Northern Alaska is that resulting from an expedition sent out in 1901 by the United States Geological Survey under Messrs. W. J. Peters and F. C. Schrader, which has lately been described in detail in a publication issued by the Survey (Professional Paper No. 20, Washington, 1904). Previous to this expedition our knowledge of the northern interior had depended chiefly on journeys made by Lieut. Howard, of the U.S. Navy, in 1886, and by Mr. J. H. Turner, in 1890, but as neither of these was able to carry out a regular survey, the recent expedition is the first which has executed a survey with precise instruments from the Yukon to the north coast. It has also, for the first time, supplied an accurate general knowledge of the physical features of this part of North America. In 1899 the discovery had been made of the probable existence of a passable route between the upper Koyukuk (a northern tributary of the Yukon, and the Arctic coast, and of this it was decided to take advantage, more especially as the gold fever following on the Klondyke discoveries had led to the foundation of a trading post at Bergman, 500 miles up the Koyukuk river. In order to avoid the necessity of wintering in this inhospitable region, a start was made from Skagway early in February, the journey down the Yukon being done by means of dog-sledging ("mushing," as it is termed). Bergman was reached on April 10, but it was then necessary to wait some time for the breaking of the ice on the Koyukuk, a description of which is given by Mr. Schrader. As in other arctic rivers, it was characterized by the arching of the ice—that in the centre being raised to a considerable height above that at the margins. Mr. Schrader thinks this is due to the permanent subterranean frost, which grips the ice with a firm hold to the shores. From Bergman the party proceeded 80 miles up the river by steamboat to Bettles, a new supply post near the 67th parallel. Starting hence on June 13, John river, a large tributary of the Koyukuk, was ascended in canoes to its headwaters, and a portage of 5 miles made through the mountains to the Anaktuvuk, the large east fork of the Colville,* which was descended to the Arctic coast. This was then followed to Point Barrow (in part in company with Eskimos), and the journey continued in an open whaleboat until a steamer was happily met at the Corwin coalfields (September 18). During the overland journey from Bergman a survey was carried out by a combination of plane-table work, triangulation, and tacheometry, while a geological examination of the country was made throughout. Mr. Schrader gives an excellent sketch both of the geographical and geological features of the region, but it is possible here to refer to the most important of these only. Three well-marked natural provinces are defined—the mountain or middle, the Koyukuk or southern, and the Arctic slope or northern. The mountain zone is regarded as the true prolongation of the Rocky mountain system, which bends westward across the international boundary, taking the curve characteristic of the concentric orography of Alaska, and embracing the Yukon basin and plateau to the south. Westward it seems to split into two branches, of which the northern terminates in the abrupt cliffs of palæozoic rocks at Cape Lisburne. The northern province is formed by a gently rolling plain bordering the mountains, and giving place seawards to an almost level tundra. These plains are considered to be the counterpart of the great plains of the western United States, while the Yukon basin seems to represent the Great Interior basin. The mountains—for which, in the section under review, Mr. Schrader adopts the name Endicott mountains, originally used by Allen in 1885—form a rugged range with a general elevation of from 5000 to 7000 feet, having the appearance of a dissected ancient plateau or peneplain. It falls more steeply to the north than to the south. The Koyukuk province again seems composed of two zones, at a higher and lower level, the features of which have been carved from two former plateaus. The Colville river, which drains the northern plains, is a large stream with a current varying from 2 to 6 miles, the latter figure referring to places where rapids occur. These would not exist, probably, at high water, which seems to take place in June. It has evidently long been cutting westwards, on which side it has high bluffs, while an extensive series of flats fringes the eastern side. This is ascribed to a general tilt of the country. The delta measures some 20 miles from east to west, and the number of mouths is greater than has been supposed. The geological formations of the country explored comprise representations of most of the geological ages from Silurian to recent, and the past structural history of the region is discussed at some length by Mr. Schrader.

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* The Colville, it will be remembered, was at one time imagined to be the termination of the Yukon, and was so shown on many maps of the middle of the nineteenth century.

An Instance of Geographical Influence upon Human Affairs.—The contrast between the old and new drift, not merely in the surface conditions, but in the economic ones, is very clearly shown in Illinois, where the great Shelbyville moraine practically separates the old drift-covered county of Cumberland to the south from the new drift-covered county of Coles to the north. The soil in the south is a heavy, rather compact grey clay, comparatively free from organic matter, overlying a greyish subsoil; while in the north the black soil, rich in humus, is a loose light loam, richer in sand, generally coarser in grain, and covers a yellow subsoil, passing downward into blue. The land requires different working. The loose northern newer drift has more marshes, but many have been drained and yield rich soil. In the impervious clays tilling would be useless, and, moreover, the natural drainage is much better developed than in the north, where the valleys are less mature. The great stream development in the south is very clearly marked on a river map. The northern farmers call their own land God's country, but the older drift beyond the morainic height, Egypt! Outside valley floors land costs from £5 to £25 an acre in the north; £3 to £6, more rarely £8, an acre in the south. The yield of crops justifies this. In Coles maize yields 30 to 40 bushels per acre, wheat 7 to 14, oats 36 and over, but hay is relatively less important, while the total value of crops per square mile is £1000 and upwards. In Cumberland maize yields only 20 to 30 bushels per acre, wheat less than 7, oats 20 to 28; hay, mowed mainly by machinery, is here from a third to a half as much again per square mile as in Coles, but the total value of crops per square mile for the entire county is only from £500 to £1000. The density of population was 65·6 per square mile in Coles in 1900, but only 46·1 in Cumberland. The town population is greater in Coles, 16,000 out of 34,000; whereas in Cumberland it is only 3000 out of 16,000. Deducting this, the density of the country area is about the same in the two counties. The greater prosperity of the northern county, however, is indicated by the number of townspeople it can support. It is remarkable that the greater prosperity of the northern county is shown, not merely in the better dwellings—log houses still are common in Cumberland—but even in the percentage of illiterates, which is 2·24 in Coles, 3·58 in Cumberland.

Honduras.—According to a monograph on Honduras issued by the International Bureau of the American Republics, the total tonnage entering its ports in the year 1901-2 amounted to 876,322, an increase of 386,123 on the tonnage of the preceding year. There are now 60 miles of railway traversing its richest agricultural districts, and transporting its produce to Puerto Cortes. The telegraph-lines in 1902 measured a length of 3249 miles. With its varied climate and fertile soil everywhere covering its lowlands and highlands, Honduras has great agricultural capacities. But its farming is still very backward, and must continue so till there are better roads, better markets, and cheaper transport. The native rarely raises more crops than will suffice him till a new harvest is gathered in. Few fields are properly ploughed, and the sown crop is left to itself. Recent years, however, show in all parts a decided advance agriculturally. Corn is the chief article of food, and maize is grown everywhere. Though two crops a year are secured, yet the supply is always short of the demand. Tobacco and coffee are raised in the mountainous districts of the west and centre. The fruit-growing region lies along the Caribbean sea, and from its ports hundreds of thousands of bananas are shipped annually to the gulf ports of the United States. Coffee-growing has struck root of late years, and Honduras coffee is of excellent quality. The cultivation of potatoes and vegetables is steadily improving and extending. About 2920 acres have been recently reclaimed by the introduction of artificial canals. This, however, is but an insignificant area compared with the area reclaimable and convertible into profitable fields. The plain of Comayagua, a barren waste in the dry season, might be turned into a fruitful garden all the year round. The broad alluvial plain, again, in the Gulf of Fonseca, now desert for five months in the year, might likewise without difficulty be made into a profitable farming district. The land under cereals in 1902 comprised 15,351 farms: 16,000 acres were under banana cultivation, 7600 acres under plantains, 5140 acres under sugar-cane, and 3700 acres under indigo. There are reported to be 410,850 orange and lemon trees, 1,239,428 coco-nut trees, 13,317,607 coffee trees, and 300,000 fruit trees of other kinds.

Railways of Brazil.—An official report (Miscellaneous Series, No. 617) by Mr. H. C. Lowther, Secretary to His Majesty's Legation at Rio de Janeiro, gives a concise account, geographical, historical, and financial, of the railway system of Brazil. The text is illustrated by maps exhibiting the lines now in working and those in construction or projected. Among recent constructions, a line lately completed between Nova Cruz and Independencia now connects the Natal and Parahyba lines. The city of Pernambuco has also for some time been joined to the Parahyba system. The original line to Palmares has likewise been connected with the line running inland from Maceio. And from this connecting link a branch extends west as far as Garanhuns, being intended to eventually reach the São Francisco river. This extension effected, uninterrupted railway communication would be established from Natal through the states of Rio Grande do Norte, Parahyba, Pernambuco, and Alagoas. Another projected line is that from Itabayanna, in the state of Parahyba, to Campina Grande, the centre of the cattle district, with ultimate extension across Parahyba into the states of Ceará and Piauhy. It is also proposed to extend the line now terminating at Garanhuns in two branches to the São Francisco river at the two extremities of the Paulo Affonso railway, which connects Piranhas with a point on the river above the cataracts. Crossing the river at Piranhas, the south branch would be carried through the state of Sergipe and connect with the Bahia system. The other branch, crossing the river further north, would also penetrate into the state of Bahia. The northern ports would by this means be brought into touch with the port of Bahia by an overland route. An unbroken line of communication would thus run through the states of Piauhy, Ceará, Rio Grande do Norte, Parahyba, Pernambuco, Alagoas, Sergipe, and Bahia. No less important are the extensions projected further south. The authorized programme for 1904 includes *inter alia* the extension of the Melhoramentos railway to join the Rio d'Ouro line at Sande; the completion of the Porto Alegre—Uruguayana, and Pernambuco—Pesqueira lines, with branches to Santa Anna do Livramento; and the construction of a line in Rio Grande do Norte, starting from a point on the coast and traversing the districts suffering from drought. There still remains a complete break in railway communications between the Bahia and Minas line on the north and the Rio Doce in Espirito Santo on the south, while of course the remote inland regions of the west lie at present quite outside the scope of railway communication.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

The Description of Climate.—In the introduction to the recently published 'Climatography of Lower Austria,' Dr. Julius Hann gives expression to certain views on the best methods of describing climate. Dr. Hann points out that a true description of climate must set forth a real part of the life of nature. It must give an intelligible account of the manner in which the meteorological elements work together to produce the final result summed up in the conception of climate—the relation of the situation of a region to its natural vegetation; and also specially to the conditions of culture and production, the positions of human settlements, and the mode of life of their inhabitants, in so far as these are affected by atmospheric influences. But the records of modern meteorological stations scarcely furnish more than a statistical skeleton for such descriptions. In the statistical basis the essential point is that the meteorological values shall be comparable as regards means, extremes, and variability. For the relatively small area of a single country the distribution of atmospheric pressure is without climatic significance; it concerns rather the larger parts of the Earth's surface, and the causes and consequences of the distribution of winds and their variations. Meteorological records, as ordinarily kept at present, contain by no means all that must be regarded as desirable from the climatographic standpoint. The "non-instrumental" observations, such as the dates of the last frost in spring and the first in autumn, and phenological observations generally, are not made with sufficient regularity to allow of proper discussion. Local variations of climate, like those due to the influence of exposure, positions in valleys or on slopes, or in the shade of mountains, can be much better studied in relation to these phenomena than from a discussion of instrumental records. Again, any climatography which is so easily applied to the elucidation of agricultural problems is seriously deficient without such non-instrumental records. Careful observations should also be made of the local distribution, frequency, and intensity of hailstorms, especially of the occurrence of destructive falls of large hailstones. In this respect Austrian meteorological records are still deficient. Reports on thunderstorms, which were introduced some years ago as a permanent part of the regular Austrian service, belong to the same category.

GENERAL.

Improving the Knowledge of the British Empire.—An important movement has been set on foot, which, if well carried out, should lead to excellent results in the way of a diffusion of more thorough knowledge of the British Empire, both in this country and the colonies. It is proposed to effect this object through the schools of the Empire, for use in which the preparation, by a thoroughly competent hand, of a series of lessons or lectures, to be illustrated by good lantern slides, has been suggested. The scheme enjoys influential support, having been first proposed by Mr. M. E. Sadler when at the Board of Education, and since adopted by the Colonial Office, at whose instance a committee was lately formed to further the objects in view. The committee has drawn up a syllabus of seven lectures on the United Kingdom, intended primarily for use in the colonies of

Ceylon, the Straits Settlements, and Hong-kong (each of which has contributed to the cost), and Mr. H. J. Mackinder has been asked to undertake, and has accepted, the task of preparing the lectures and generally supervising the scheme. Before being printed, the lectures (which will aim at giving children through their eyes, as well as their ears, a true and simple impression of what the United Kingdom and its people are like) will be delivered in a London Training College for elementary teachers. Meanwhile Mr. Mackinder has arranged to give, on December 7, an account of the scheme in a lecture to be delivered at the Whitehall Rooms, Hotel Metropole, at 5 p.m. It is hoped that those interested in promoting mutual knowledge of the various parts of the Empire will be present. It is anticipated that the Eastern Colonies will also supply material for similar lectures upon them, to be used in this country.

The British Science Guild.—With a view to cultivating the scientific spirit in this country, and bringing home to all classes the necessity of applying scientific treatment to affairs of all kinds, an association has lately been formed under the name of "The British Science Guild," which will endeavour to further the objects in view by means of publications and meetings and other similar methods. The guild will aim at bringing before those responsible for the carrying on of the nation's activities the importance of the extended application of scientific principles, and, in particular, will endeavour to promote scientific education by encouraging the support of universities and other institutions where science is represented. An organizing committee has already been formed, and Sir Norman Lockyer elected president of the guild, membership of which is open to all British subjects. It may seem to some surprising, not to say humiliating, that so elementary a principle as the importance of well-ordered knowledge to the successful prosecution of any enterprise should stand in need of championing by an association of the kind at this late period in the nation's history. But there can be no doubt of the benefits that would accrue from a still wider recognition of the principle, and it may be hoped that the efforts of the new body may meet with the success which they certainly deserve. The Secretary is C. Cuthbertson, Esq., 9, York Terrace, Regent's Park, London, N.W.

Geographical Awards at the St. Louis Exhibition.—The exhibits bearing on geography at the St. Louis International Exhibition were placed under two separate groups of the Department of Liberal Arts, viz. (17) Books and Publications, and (18) Maps and Apparatus for Geography. The awards for such exhibits to British exhibitors in these groups, which had been approved by the Superior Jury up to October 20 last, were as follows: In Group 17, gold medals were given to the Royal Geographical Society, the Egypt Exploration Fund, and the Palestine Exploration Fund. In Group 18, the Grand Prize—the highest honour granted—was awarded to the Ordnance Survey, the Royal Geographical Society, the Hydrographical Department of the Admiralty, the Survey of India, the Palestine Exploration Fund, and to Messrs. J. Bartholomew & Co. Gold medals were awarded to Mr. Edward Stanford (with silver medal to Mr. John Bolton as Collaborator), to Messrs. W. & A. K. Johnston, and to Mr. George Armstrong (as Collaborator to the Palestine Exploration Fund). A silver medal was also awarded to Messrs. Cary and Porter, Ltd., for the surveying instruments supplied to the Royal Geographical Society and exhibited under the auspices of the latter. British Geographical exhibitors have, therefore, every reason to be content with the results of the awards, having secured six grand prizes out of a total of 130 awarded to British exhibitors under all departments.

OBITUARY.

Field-Marshal Sir Henry W. Norman, G.C.B., G.C.M.G., C.I.E.

By the death of Sir Henry Norman the Royal Geographical Society has lost one of its best supporters—one of its most trusted Councillors. Always at his post, and always ready to give the best of his attention to the business in hand, this man, who had been member of the highest councils of the land, governor of British colonies, and nominated Viceroy of India, never seemed to think time wasted or energy spent in vain over the consideration of the most trifling details of the Society's administration. He was indeed a model councillor. On a raw, foggy November afternoon, when a few scattered military enthusiasts had collected together in the arena of the United Service Institution lecture hall to listen to a technical address, I have heard Sir Henry Norman express a strong opinion on the absence of members of the council of that institution who had more concern for their health than for the support of the lecturer.

Field-Marshal Sir Henry Wylie Norman, G.C.B., G.C.M.G., was born December 2, 1826, and joined the Indian army in 1844, serving as adjutant of his regiment (31st Bengal Infantry) through the Sikh wars. During the period intervening between the conquest of the Punjab and the Mutiny, Norman (associated with Sir H. Lumsden and Lord Roberts in the early stages of their military career) was much employed on the staff of the Indian army (chiefly in the adjutant-general's department), and it was then that he made acquaintance with the frontiers of India under Sir Charles Napier and Sir Colin Campbell; and it was then, no doubt, that he formed his first views on the policy that should be adopted by the Indian Government towards the frontier tribes and Afghanistan. He was always a strong advocate for "non-interference," and it is possible that our present position on the north-west frontier, where our boundaries are still, practically, the boundaries that we inherited by right of conquest from the Sikhs, is largely due to his insistence and his influence. His political views on this subject did not, however, impair his active interest in the extension of geographical knowledge of the border land by any means short of military measures. He never for an instant ignored the necessity for a widespread acquaintance with frontier topography. During the stirring times of the Mutiny, Norman was at the front and constantly busy. We find him associated with Roberts in the risky work of superintending the final arrangements for the last great assault on Delhi, and subsequently with the Cawnpore field force, and at the capture of Lucknow by Sir Colin Campbell. It was during the attack on the Residency that Norman especially distinguished himself. He was afterwards wounded at Bareilly; in short, he was in the thick of the fighting during the whole Mutiny period, and his subsequent reports and narratives of the events in which he bore so distinguished a part are known to military students all the world over.

Then his advancement was rapid. He became military secretary to the Duke of Cambridge, acted as Adjutant-General to the Indian army, and was appointed military Member of Council in India in June, 1870. In India he was best known as the "father" of the Indian Staff Corps; and although that institution has been much criticized, and finally died a natural death some two years before that of its great originator, it may well be doubted whether, on the whole, it did not answer its purpose efficiently, even if it involved certain difficulties in military administration.

Norman took up a strong position as an opponent of what has often wrongly been called the "forward policy" in India. He was opposed to the Afghan war;

he was opposed to the occupation of Kandahar; he even advocated the abandonment of Quetta; and yet he certainly was no advocate for "masterly inactivity," and there is good reason to suppose that the policy of reduction in the Indian army, combined with a general curtailment of military expenditure in India to which he was asked to pledge himself by Gladstone, was one of the chief reasons for his final refusal of the Vice-royalty of India in succession to Lord Lansdowne. It is not difficult to reconcile such views if we regard Sir Henry as strong for a defensive, whilst deprecating an aggressive, policy in India.

But the refusal of such a magnificent offer marks the character of the man more surely than reams of writing could do. Devoted to his ideal of duty, unswerving from the straight path of honour, he would admit of no compromise with his convictions. On retirement from the Indian council, Sir Henry was appointed Governor of Jamaica, and afterwards (in 1888) Governor of Queensland. He was made Governor of Chelsea Hospital in 1901, and was gazetted Field-Marshal in June, 1902. During these later years he was a constant and consistent supporter of the Royal Geographical Society, where he won the friendship and esteem of all those who were associated with him on its Council. Modest, unassuming, kind-hearted, and generous, his best advice and assistance were always at the service of his friends, and in the long roll of illustrious names which are associated with the records of the Society, none will carry with them happier memories of grave and courteous consideration of all its many varied interests than that of Sir Henry Wylie Norman.

T. H. H.

Edward Stanford.

Mr. Edward Stanford, the well-known map publisher, died on November 3, 1904, in his seventy-eighth year, at Sidmouth in Devonshire, where he had lived in retirement for seventeen years, suffering the martyrdom of chronic asthma. He was born in London, and educated at the City of London School, and became a Fellow of our Society in 1853.

His interest in maps was first aroused when he joined Mr. Trelawney Saunders as an assistant in 1848. Mr. Saunders had created a map and chart business at 6, Charing Cross, next door to Augustus Petermann, who was at that time working as a geographical draughtsman in London. In 1852 Mr. Stanford became a partner in Mr. Saunders's business, and in 1853 the partnership was dissolved and he became sole proprietor. After establishing himself firmly in his new business, he commissioned the late Dr. Alexander Keith Johnston to construct and engrave a series of library maps of the great continents, the finest series of maps published in this country since the grand series of wall maps produced by Aaron Arrowsmith at the close of the eighteenth century. During the time that these maps were in preparation and in course of publication, Mr. Stanford employed Mr. Trelawney Saunders in superintending the construction of a library map of London. At this time the sole official survey of London was a skeleton map showing main roads only, surveyed by the Royal Engineers for the Commissioners of Sewers of the Metropolis on a scale of 12 inches to 1 mile. Using this 12-inch map as a groundwork, surveyors were employed to fill in the details, and as fast as the sheets came in from the surveyors they were reduced to the scale of 6 inches to 1 mile, and were engraved with infinite pains on steel plates. This map was completed and published in 1862, the most perfect map of London that had ever been issued. In 1873, after the death of John Arrowsmith, the copper plates of the maps forming his London atlas were bought by Mr. Stanford, who proceeded at once, with his accustomed energy, to have the plates, which had been suffered to remain much in the state they were on first publication, corrected and brought up to date, afterwards supplementing them with many new plates. This atlas was first published by John Arrowsmith in 1834 with fifty plates, and received the honour of a special article in the Society's *Journal* for that year. Mr. Stanford re-issued the atlas in 1887 with ninety plates. An atlas of this magnitude can only be perfected by gradual additions in successive issues, and it was in this manner that Mr. Stanford designed to perfect the atlas originated by John Arrowsmith on the recommendation of his friend Thomas Murdoch. In 1882 a survey of the island of Cyprus on the scale of 1 inch to 1 mile was executed by Captain (now Lord) Kitchener and Lieut. (now Major) S. C. N. Grant, by order of the High Commissioner; but after the survey was completed there were no funds available to engrave and lithograph it. Mr. Stanford undertook to engrave and publish it at his own expense, a very public spirited piece of work, as it was not expected to be a commercial success. The map, engraved on fifteen copper plates, was published in 1885, and has been of great use to the Cyprus Government. Mr. Stanford's business was compulsorily removed in 1873 from 6, Charing Cross by the Metropolitan Board of Works, for the purpose of making Northumberland Avenue, and again from 55, Charing Cross by the Office of Works for the forming of the new street from the Mall to Charing Cross. On the 31st Dec., 1885, Mr. Stanford finally retired from business, having previously presented to our Society a complete set of his publications in a series of ten cases. J. B.

CORRESPONDENCE.

Dr. Sven Hedin's Observations on Sand-dunes.

On p. 543, vol. xxiv., of the *Geographical Journal* (November, 1904), Dr. Sven Hedin writes—

"In between these stupendous waves of sand . . . there exist hollows or kumatic valleys. . . . Each is called by the natives a *bajir*, and forms a small self-contained basin, with a clay bottom, and is surrounded by sand, steep on the east side, and with a slow ascent to the next crest on the west. The lakes on the right bank of the Tarim are nothing but *bajir* depressions of this character, which by pure chance have become filled with water."

Readers of the *Journal* may be interested to refer for illustrations of such forms to my paper "On Desert Sand-dunes bordering the Nile Delta," January, 1900, Plate II., Fig. 24; and to that "On Sand-waves in Tidal Currents," August, 1901, Plate I., Fig. 12. The first figure is a photograph of a hard-bottomed depression of the *bajir* form among sand-hills; the second shows a chain of lakelets of the same form. Their homology with the dry depressions, or *fuljes*, is stated on p. 182.

Dr. Sven Hedin's observations on so large a scale, and among such different surroundings, illustrate the almost mathematical precision which is attainable in the study of surface forms in granular materials.

Vaughan Cornish.

"The Balkan Peninsula."

Je reçois au bord de la mer le *Geographical Journal* de Septembre.

J'y trouve (p. 345) un article relatif à un mémoire lu à la Société de géographie de Roumanie par M. Stourdza dont je n'avais pas eu connaissance.

Je partage son opinion. Il est tout à fait illogique de classer dans la région

balkanique la Roumanie, pays qui appartient à la region karpatienne. Il m'a toujours paru illogique aussi de comprendre le Peloponèse et même le reste de la Grèce dans une division territoriale qui emprunte son nom aux Balkans. Il est nécessaire, pour les géographes, et particulièrement pour l'enseignement de la géographie, d'avoir une dénomination spéciale pour chacune des trois péninsules de l'Europe mêridionale. Mais laquelle?

M. Stourdza propose "Péninsule Thraco-illyrienne." Je n'ai aucune objection à faire contre cette dénomination.

Il y a trente ans, quand j'ai commencé à composer des ouvrages de géographie classique, j'ai adopté une autre dénomination que j'ai toujours conservée et que je me permets de vous soumettre, celle de *Péninsule pélasgique.*

J'ai donné à chacune des trois grandes péninsules un nom simple, tiré de l'ethnographie.

Péninsule Ibérique (je ne dis pas Hispanique, puisque le Portugal y est compris).
Péninsule Italique.
Péninsule Pélasgique.

Sans doute le mot "pélasgique" est vague, comme l'histoire de la race à laquelle il est emprunté. Mais on peut dire que le vague convient précisément à un pays où tant de races se trouvent juxtapposées. L'expression Thraco-illyrienne est loin de les embrasser toutes.

Je dois avouer toutefois que le mot pélasgique n'a pas fait fortune. Peu de géographes l'ont adopté en France.

E. Levasseur.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1904-1905.

Special Meeting, November 7, 1904, in the Royal Albert Hall.—Sir Clements Markham, K.C.B., President, in the Chair.

Elections.—*Hon. E. Coke; Rev. William G. Donaldson; Charles Turville Gardner; Russell Davis Gillman; John Henderson; Charles Percy Perry; Robert L. Reid; John B. Sainsbury; Captain P. H. Short (Gloucester Regt.); H. R. Stephenson; Gordon le Suer; Thomas James Thomas; Andrew Peter William Williamson; Arthur Dudley Yorke.*

The paper read was:—

"The Work of the National Antarctic Expedition." By Captain R. F. Scott, C.V.O., R.N.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Col. = Colonies.
Com. = Commerce.
C. R. = Comptes Rendus.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
Jb. = Jahrbuch.
k. u. k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. (**mém.**) = Memoirs, Mémoires.
Met. (**mét.**) = Meteorological, etc.
P. = Proceedings.
R. = Royal.
Rev. (**Riv.**) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Alps. **Penck and Brückner.**
Die Alpen im Eiszeitalter. Von Dr. A. Penck und Dr. E. Brückner. Lieferung 6. Leipzig: C. H. Tauchnitz, 1904. Size 10½ × 7½, pp. 545–656. *Map and Illustrations. Presented by the Publisher.*

Austria. *M.k.k.G. Ges. Wien* 47 (1904): 91–95. **Schaffer.**
Zur Frage der alten Flussterrassen in Wien. Von Dr. F. X. Schaffer.
Noticed in the Monthly Record (*ante*, p. 673).

Austria—Geodesy. ———
Publikationen für die Internationale Erdmessung. Die Astronomisch-Geodätischen Arbeiten des K. und K. Militär-Geographischen Institutes in Wien. XX. Band. Astronomische Arbeiten. 8. Polhöhen und Azimuth-Messungen auf den Stationen Arber, Böhmerwall, Hora, Kohout, Kubány, Markstein (nur Polhöhe), Maydenberg, Predigstuhl (nur Polhöhe), Schöninger (nur Polhöhe), Spittlmais und Viehberg. Herausgegeben vom K. und K. Militär-Geographischen Institute. Wien, 1903. Size 12 × 9½, pp. vi. and 194. *Presented by the K. u. K. Militär-Geogr. Institut.*

Austria—Lissa. *B.S.G. Italiana* 5 (1904): 423–447, 530–550. **Martelli.**
Osservazioni geografico-fisiche e geologiche sull' isola di Lissa. Del dott. A. Martelli. *With Map.*

Balkan Peninsula. **Cvijić.**
Die Tektonik der Balkanhalbinsel mit besonderer Berücksichtigung der neueren Fortschritte in der Kenntnis der Geologie von Bulgarien, Serbien und Makedonien. Von J. Cvijić. Wien, 1904. Size 10 × 7½, pp. 347–370. *Map.*

Balkan Peninsula. *G. Anzeiger* 5 (1904): 123–127. **Stavenhagen.**
Die Kartographie der Balkanhalbinsel im XIX. Jahrhundert. Von W. Stavenhagen.

Europe—Health Resorts. **Linn.**
The Health Resorts of Europe. A Medical Guide to the Mineral Springs, Climatic Mountain and Seaside Health Resorts, Milk, Whey, Grape, Earth, Mud, Sand, and Air Cures of Europe. By Dr. T. Linn. Twelfth Edition. London: The Health Resorts Bureau, 1904. Size 7 × 5, pp. 258. *Presented by the Health Resorts Bureau.*

France. *C. Rd.* 139 (1904): 179–181. **Gosselet.**
Cartes hypsométriques des assises crétaciques dans le nord de la France. Région de Douai. Note de J. Gosselet.

France—Corsica. *Geolog. Mag.* 1 (1904): 388–392. **Bonney.**
Some Eroded Rocks in Corsica. By Prof. T. G. Bonney, D.SC. *With Plate.*

France—Corsica. **Le Bondidier.**
B.S.G. de l'Est 24 (1903): 307–328, 404–428; 25 (1904): 29–40.
En Corse. Carnet de route. Par L. Le Bondidier.

France—Rhone, etc. *B.S.G. Lyon* **19** (1904): 97-126. **Turquan.**
Géographie agricole, industrielle, commerciale et économique du département du Rhône et régions environnantes. Par V. Turquan. ***With Maps.***

Germany. *G.Z.* **10** (1904): 279-280. **Günther.**
Seeschwankungen (Seiches) am Chiemsee. Von Prof. Dr. S. Günther.

Germany. **Linde.**
Die Lüneburger Heide. Von Dr. R. Linde. (Land und Leute . . . herausgegeben von A. Scobel, xviii.) Bielefeld und Leipzig: Velhagen and Klasing, 1904. Size 10 × 7, pp. 150. ***Map and Illustrations.***

Germany. *Notizbl. V. Erdk. Darmstadt* (IV. F.) **24** (1903): 17-37. **Steuer.**
Geologische Beobachtungen im Gebiet der alten Mündungen von Main und Neckar in den Rhein. Von A. Steuer. ***With Plate.***

Germany—Erzgebirge. **Rathsburg.**
Geomorphologie des Flöhagebietes im Erzgebirge. Von Dr. A. Rathsburg. (Forschungen zur deutschen Landes- und Volkskunde . . . herausgegeben von Dr. A. Kirchhoff. XV. Band, Heft 5.) Stuttgart: J. Engelhorn, 1904. Size 9½ × 6½, pp. 347-541. ***Maps.***

Germany—Fishing Trade. **Oliver.**
Fishing Trade of the Weser Seaports. Foreign office, Miscellaneous, No. 616, 1904. Size 9½ × 6½, pp. 12. *Price* 1*d.*

Germany—Historical. *Globus* **86** (1904): 37-41. **Binzer.**
Die Römerwege zwischen der Unterweser und der Niederelbe und die mutmasslichen Ankerplätze des Tiberius im Jahre 5 n. Chr. Von O. A. L. v. Binzer.

Germany—Ice Conditions. *Ann. Hydrographie* **32** (1904): 401-407. ——
Die Eisverhältnisse an den deutschen Küsten im Winter 1903-04. ***With Diagram.***

Germany—Oder. *G.Z.* **10** (1904): 316-332. **Fischer.**
Entstehung und Verlauf des Oderhochwassers im Juli 1903. Nach einem Vortrage im Berliner Zweigverein der deutschen meteorologischen Gesellschaft. Von Dr. K. Fischer. ***With Diagrams.***

Iceland. **Hann.**
Die Anomalien der Witterung auf Island in dem Zeitraume 1851 bis 1900 und deren Beziehungen zu den gleichzeitigen Witterungsanomalien in Nordwesteuropa. Von J. Hann. (Aus den Sitzungsberichten der K. Akad. der Wissenschaften in Wien. Mathem.-naturw. Klasse, Bd. cxiii. Abt. IIa. Jänner, 1904.) Size 10 × 6½, pp. 88. *Presented by the Author.* [Noticed *ante*, p. 673.]

Iceland. *G. Tidskrift* **17** (1903-1904): 181-186. **Thoroddsen.**
En Udflugt til Vulkanen Skjaldbreid paa Island. Af Prof. Dr. T. Thoroddsen.

Italy. *Quarterly J. Geolog. S.* **60** (1904): 296-315. **Lorenzo.**
The History of Volcanic Action in the Phlegræan Fields. By Prof. G. de Lorenzo. *With Maps and Sections.*

Italy—Apennines. *Riv. G. Italiana* **11** (1904): 305-319. **Grasso.**
Per la storia della conoscenza dell' Apennino. Di G. Grasso.

Italy—Historical. *Riv. G. Italiana* **11** (1904): 1-12, 136-145, 226-236. **Marinelli.**
Giovanni Targioni Tozzetti e la illustrazione geografica della Toscana. Communicazione di O. Marinelli.

Dwells on the importance of Targioni's contributions to a geographical knowledge of Tuscany in the eighteenth century.

Italy—Piedmont. *Riv. G. Italiana* **11** (1904): 184-187. **Dainelli.**
Le isole linguistiche tedesche in Piemonte. G. Dainelli.

Mediterranean—Winter Resorts. **Reynolds-Ball.**
Mediterranean Winter Resorts. By E. A. Reynolds-Ball. Fifth Edition. London: Hazell, Watson & Viney, 1904. Size 7 × 4½, pp. xxvii. and 618. ***Maps and Plans.*** *Price* 6*s.* *Presented by the Publishers.*

The new edition of this well-known and useful guide has been still further enlarged, both by additional details throughout and by sections dealing with places not hitherto touched upon, *e.g.* Cyprus and Khartum. Its handy form is, however, preserved by the use of specially thin but tough paper.

Meuse. *Mém. Couronnés, etc., A.R. Belgique* 62 (6), (1904): pp. 30. **Vanhove.**
Étude pluviométrique sur le bassin de la Meuse. Par D. Vanhove. *With Map.*

North Sea—Coasts. **Warming.**
Mém. A.R. Sci., etc., Danemark 2 (No. 1) (1904): pp. 56.
Bidrag til Vadernes, Sandenes og Marskens Naturhistorie. Af Dr. E. Warming. Under medarbejde af Dr. Wesenberg-Lund, E. Østrup og fl. Avec un *Résumé* en Français. *With Map and Illustrations.*

On sand and mud banks on the coasts of the North sea, and the animal and vegetable life associated with them.

Norway—Glommen. *G.Z.* 10 (1904): 277–279. **Reusch.**
Das Knie des Glommenflusses in Norwegen. Von Dr. H. Reusch. *With Map.*

Norway—Tides. ———
Resultater af Vandstands-Observationer paa den Norske Kyst. Hefte vi. (Udgivet af den Norske Gradmaalings-Kommission.) Kristiania: W. C. Fabritius & Sønner a/s., 1904. Size 12 × 9½, pp. 60. *Diagrams.*

Norway and Sweden—Glommen. *Ymer* 24 (1904): 226–229. **Reusch.**
Glommen til Sverige? Af H. Reusch.

On a possible diversion of the course of the Glommen from Norway to Sweden.

Pyrenees. *A travers le Monde, Tour du Monde* 10 (1904): 285. ———
Projet de trois nouvelles Voies ferrées à travers les Pyrénées. *With Map.*

See note in Monthly Record for November (p. 585).

Rumania. *C. Rd.* 139 (1904): 226–227. **Martonne.**
Sur les terrasses des rivières karpatiques en Roumanie. Note de E. de Martonne.

Rumania. *C. Rd.* 139 (1904): 316–318. **Martonne.**
Sur l'évolution de la zone des dépressions subkarpatiques en Roumanie. Note de E. de Martonne.

Spain—Bilbao. *Deutsch. Rundschau G.* 26 (1904): 450–452. **Nebehay.**
Bilbao als Zukunftshafen. Von Karl Nebehay. *With Illustration.*

Sweden. *Ymer* 24 (1904): 180–186. **Wiklund.**
Namnet Luleå och de forna nationalitetsförhållandena i Norrbotten. Af K. B. Wiklund.

On the name Luleå and former political relations in Norbotten.

Sweden—Plankton. **Lemmermann.**
Arkiv Botanik, K. Svensk Vet.-A. 2 (No. 2) (1904): pp. 210.
Das Plankton schwedischer Gewässer. Von E. Lemmermann. *With Plates.*

Switzerland. **Vincent.**
Switzerland at the beginning of the Sixteenth Century. By J. M. Vincent. (Johns Hopkins University Studies. Series xxii. No. 5.) Baltimore, 1904. Size 10 × 6, pp. 62.

Switzerland. **Weber.**
Beiträge zur geologischen Karte der Schweiz, herausgegeben von der Geologischen Kommission der Schweiz. Naturforschenden Gesellschaft auf Kosten der Eidgenossenschaft. Neue Folge, xiv. Lieferung. Des ganzen Werkes 44. Lieferung. Ueber den Kali-Syenit des Piz Giuf und Umgebung (östliches Aarmassiv) und seine Ganggefolgschaft. Von Dr. F. Weber. Bern: A. Francke, 1904. Size 12½ × 9½, pp. x. and 182. *Maps and Plates. Price* 10*f. Presented by the Publisher.*

Switzerland—Bernese Oberland. **Wäber.**
Jahrb. Schweiz. Alpenclub 39 (1903–1904): 212–261.
Zur Geschichte des Fremdenverkehrs im engeren Berner Oberlande. 1763–1835. Von A. Wäber. *With Illustrations.*

Switzerland—Lake of Geneva. *Quarterly J. Geolog. S.* 60 (1904): 316–318. **Preller.**
Phenomena bearing upon the Age of the Lake of Geneva. By C. S. Du Riche Preller. [Abstract.]

United Kingdom—Ireland. *Blackwood's Mag.* 176 (1904): 313–328. **Gwynn.**
From Tory to Aran. By S. Gwynn.

On a recent cruise which enabled the writer to study the work of the Congested Districts Board.

United Kingdom—Rainfall. **Mill.**

British Rainfall, 1903. On the Distribution of Rain over the British Isles, during the year 1903, as observed at nearly 4000 stations in Great Britain and Ireland, with articles upon various branches of Rainfall work. Compiled by Dr. H. R. Mill. London: E. Stanford, 1904. Size 9 × 6, pp. 68 and 300. *Frontispiece, Maps, and Diagrams. Price 10s. Presented by the Compiler.*

Some new features have been added in this volume (the first for which Dr. Mill takes the entire responsibility), rendering it still more valuable than hitherto to those interested in rainfall matters. Special mention should be made of the improvement of the maps and the addition of those illustrating remarkable cases of heavy and widespread rainfalls.

United Kingdom—Suffolk. *Geolog. Mag.* 1 (1904): 502–504. **Spiller.**

Recent Coast Erosion in Suffolk: Dunwich to Covehithe. By J. Spiller.

United Kingdom—Teign. **Jukes-Browne.**

Quarterly J. Geolog. S. 60 (1904): 319–334.

The Valley of the Teign. By A. J. Jukes-Browne. *With Maps.*

Cf. note in *Journal* for May, 1904 (p. 679).

United Kingdom—Wales. **Strahan, Gibson, and Cantrill.**

Memoirs of the Geological Survey, England and Wales. The Geology of the South Wales Coal-Field. Part v. The Country around Merthyr Tydfil, being an account of the region comprised in Sheet 231 of the Map. By A. Strahan, W. Gibson, and T. C. Cantrill. London: E. Stanford, 1904. Size 10 × 6½, pp. viii. and 132. *Maps and Sections. Price 1s. 6d.*

ASIA.

Armenia—Place-names. **Hübschmann.**

Die altarmenischen Ortsnamen. Mit Beiträgen zur historischen Topographie Armeniens. Von H. Hübschmann. (Sonderabdruck aus dem 16 Bande der Indogermanischen Forschungen von K. Brugmann und W. Streitberg.) Strassburg: K. J. Trübner, 1904. Size 9 × 6, pp. 197–490. *Map. Price 8s.*

Asia. **Ronaldshay.**

On the Outskirts of Empire in Asia. By the Earl of Ronaldshay. Edinburgh and London: W. Blackwood & Sons, 1904. Size 9½ × 7, pp. xxii. and 408. *Maps and Illustrations. Price 21s. net. Presented by the Publishers.*

An attempt "to place before the public an account of some of the less accessible countries of Asia, and of the problems to which their existence and present position give rise." The author's route led through Turkey, Persia, Russian Central Asia, Siberia, Manchuria, and Japan.

Cambodia. *B. Économique (Indo-Chine)* 7 (1904): 375–379. **Achard.**

Note sur les terres riveraines du Mékong, au Cambodge. Par E. L. Achard.

Central Asia. **Younghusband.**

The Heart of a Continent. A Narrative of Travels in Manchuria, across the Gobi Desert, through the Himalayas, the Pamirs, and Hunza. 1884–1894. By Colonel F. E. Younghusband. [Fourth Edition.] London: John Murray, 1904. Size 9 × 6, pp. xviii. and 332. *Map and Illustrations. Price 6s. net. Presented by the Publisher.*

Mr. Murray has done good service by supplying the public with a new edition of this well-known work at a moderate price. The get-up is excellent.

Ceylon. **Grinlinton.**

Ceylon: Administration Reports, 1903. Part ii.—Scientific Survey Department. Report of Mr. F. H. Grinlinton, C.M.G., Surveyor-General. Size 13½ × 8½, pp. 32. *Portrait, Map, and Plans. Presented by the Surveyor-General of Ceylon.*

China. *B. Comité l'Asie Française* 4 (1904): 266–272. **Grillières.**

Réception du lieutenant Grillières. *With Map.*

Lieut.-Grillières has lately made a journey of exploration in Yunnan and on the Tibetan border.

China—Geology. *Asien* 8 (1904): 52–55, 91–94. **Tiessen.**

Die Grundzüge des Gebirgsbaues und die Bodenschätze Chinas. Von Dr. E. Tiessen.

China—Szechuan. *Scottish G. Mag.* **20** (1904): 393-403. **Little.**
The Irrigation of the Chentu Plateau. By A. Little. *With Maps and Illustrations.*

China—Shantung. *B. Comité l'Asie Française* **4** (1904): 331-336. **Pila.**
Une province Chinoise en progrès: le Chantoung. Par F. Pila.

China—Weihaiwei. ———
Weihaiwei. Report for 1903. Colonial Reports, Annual No. 419, 1904. Size 10 × 6, pp. 60. *Price 3d.*

Chinese Empire—Tibet. *Nineteenth Century* **56** (1904): 113-118. **Boulger.**
The Capture of Lhasa in 1710. By D. C. Boulger.

On the taking of Lhasa by the Eleuths.

Chinese Empire—Tibet. *Imp. and Asiatic Quarterly Rev.* **18** (1904): 28-43. **Bruce.**
Our Relations with Tibet. By Captain G. E. Bruce.

Chinese Empire—Tibet. *Monthly Rev.* **16** (1904): 60-82. **Reid.**
What I saw in Thibet. By W. C. Jameson Reid.

It is difficult to form an opinion whether this describes an actual journey, or whether the intention is merely to present a picture of Tibetan characteristics in the form of an imaginary narrative of travel. The writer's qualifications may be doubted when we read of the Yangtse having its source in the Koko nor!

Chinese Empire—Tibet. *Fortnightly Rev.* **76** (1904): 124-134. **Parker.**
The Bottom-rock of the Tibet Question. By E. H. Parker.

Eastern Asia. **Douglas.**
Europe and the Far East. By Sir Robert K. Douglas. Cambridge: The University Press, 1904. Size 8 × 5½, pp. viii. and 450. *Maps. Price 7s. 6d. Presented by the Publishers.*

A valuable summary, suitable for general readers, of the relations between European powers and the Eastern empires, especially during the last century. The earlier attempts to open up intercourse are very briefly touched upon, and no mention is made of the earliest French trading ventures at the close of the seventeenth century.

India—Hyderabad. **McAuliffe.**
The Nizam; the Origin and Future of the Hyderabad State, being the Le Bas Prize Essay in the University of Cambridge, 1904, by R. P. McAuliffe. London: C. J. Clay & Sons, 1904. Size 8 × 5½, pp. xii. and 86. *Price 2s. 6d. net. Presented by the Author.*

The writer has selected from the mass of historical facts available those which throw light on the still unfinished evolution of the state through centuries of political consolidation.

India—Spiti. *Mem. Geolog. Surv. India* **36** (Pt. i.) (1904): pp. 130 and vi. **Hayden.**
The Geology of Spiti, with parts of Bashahr and Rupshu. By H. H. Hayden. *With Map and Plates.*

India—Surveys. **Gore.**
Extracts from Narrative Reports of the Survey of India for the season 1901-1902. Prepared under the direction of Colonel St. G. C. Gore, C.S.I., Calcutta, 1904. Size 13 × 8½, pp. 58. *Presented by the Surveyor-General of India.*

Japan. *Imp. and Asiatic Quarterly Rev.* **18** (1904): 140-155. **Parker.**
The Attempt made by Kublai Khan to Conquer Japan. By E. H. Parker. *With Map.*

Japan—Formosa. *Meteorolog. Z.* **21** (1904): 383-387. **Hann.**
Klima von Formosa (Taiwan). Von J. Hann.

Japan—Historical. **Haas.**
Geschichte des Christentums in Japan. Von Pfarrer Dr. H. Haas. II. Fortshritte des Christentums unter dem Superiorat des P. Cosmo de Torres. (Supplement der Mitteilungen der Deutschen Gesellschaft für Natur- und Völkerkunde Ostasiens.) Tokyo, 1904. Size 9½ × 6½, pp. xxviii. and 384. *Presented by the Deutsche Gesellschaft für Natur- und Völkerkunde Ostasiens.*

Korea. **Bourdaret.**
Émile Bourdaret. En Corée. Paris: Plon-Nourrit et Cie., 1904. Size 7½ × 5, pp. 364. *Illustrations. Price 3s.*

An account of recent journeys in Korea, for the most part by well-known routes, but useful as a contribution to further knowledge of a country now attracting public attention.

Malay Archipelago—Sumatra. ——
Bijd. Taal-, Land- en Volkenk. Ned.-Indië 2 (1904): 548–557.
Korte beschrijving van het landschap Bila. *With Map.*

Malay Peninsula. *Scottish G. Mag.* 20 (1904): 337–348. **Annandale.**
The Peoples of the Malay Peninsula. By Nelson Annandale. *With Illustrations.*

Malay Peninsula. **Annandale and Robinson.**
Fasciculi Malayenses. Anthropological and Zoological Results of an Expedition to Perak and the Siamese Malay States, 1901–1902. Undertaken by N. Annandale and H. C. Robinson. Anthropology. Part IIa. London: Williams & Norgate, 1904. Size 10½ × 8, pp. 116. *Illustrations. Price* 10*s. net. Presented.*

Malay States. **Belfield.**
Handbook of the Federated Malay States. Compiled by H. C. Belfield. Second Edition. London: E. Stanford, [1904]. Size 8½ × 5½, pp. 174. *Maps and Illustrations. Price* 2*s.* 6*d. Presented by the Publisher.*

Gives the most complete information to be found, in equally small compass, on the Federated Malay States and their economic resources. The statistics in this edition have been brought down to the end of 1902.

Pamirs. **Olufsen.**
Through the Unknown Pamirs. The Second Danish Pamir Expedition 1898–99. By O. Olufsen. London: W. Heinemann, 1904. Size 9 × 6, pp. xxii. and 238. *Maps and Illustrations. Price* 15*s. net. Presented by the Author.*

A distinct addition to our knowledge of the Pamirs. Instead of a mere narrative of travel, it presents the results of the author's and his companions' observations in a series of chapters dealing with different aspects of the country and its inhabitants.

Persia. **Morgan.**
Mission scientifique en Perse. Par J. de Morgan. Tome v. Études linguistiques, dialectes Kurdes, langues et dialectes du nord de la Perse. Paris: E. Leroux, 1904. Size 11½ × 9, pp. xvi. and 326. *Map.*

Persia. *Scottish G. Mag.* 20 (1904): 403–415. **Sykes.**
Life and Travel in Persia. By Miss E. Sykes.

Philippine Islands. *Contemporary Rev.* 86 (1904): 392–404. **Foreman.**
The Americans in the Philippines. By J. Foreman.

Philippine Islands. ——
Population of the Philippines. (Census of the Philippine Islands: 1903. Bulletin 1.) Department of Commerce and Labor, Bureau of the Census, 1904. Size 9 × 6, pp. 100.

See note in the October number (p. 480).

Philippine Islands. *Imp. and Asiatic Quarterly Rev.* 18 (1904): 130–139. **Steuart.**
The English in the Philippines. By A. F. Steuart.

Refers to the English occupation of Manila, 1762–64.

Philippine Islands—Climate. **Algué.**
The Climate of the Philippines. By Rev. J. Algué, S.J. (Census of the Philippine Islands, 1903. Bulletin 2.) Department of Commerce and Labor, Bureau of the Census, 1904. Size 9 × 6, pp. 104. *Maps and Diagrams.*

Philippine Islands—Volcanoes. **Masó.**
Volcanoes and Seismic Centers of the Philippine Archipelago. By Rev. M. Saderra Masó, S.J. (Census of the Philippine Islands, Bulletin 3.) Department of Commerce and Labor, Bureau of the Census, 1904. Size 9 × 6, pp. 80. *Maps and Illustrations.*

Russia—Caucasus. *B. American G.S.* 36 (1904): 327–341. **Hovey.**
Southern Russia and the Caucasus Mountains. By E. O. Hovey.

Notes collected during the excursion of the International Geological Congress in 1897.

Russia—Caucasus. *La G., B.S.G. Paris* 10 (1904): 65–68. **Martel.**
Mission Scientifique au Caucase Occidental, par M. E. A. Martel. Par F. Lemoine.

Russian Central Asia. *M.G. Ges. Hamburg* **20** (1904): pp. 312. **Friederichsen.**
Forschungsreise in den Zentralen Tiënschan und Dsungarischen Ala-tau (Russisch Zentral-Asien) im Sommer 1902. Von Dr. M. Friederichsen. *With Maps and Illustrations.* [To be reviewed.]

Straits Settlements. **Ireland.**
Studies in Colonial Administration VII. The Straits Settlements. By A. Ireland. (From the *Outlook*, May 14, 1904, pp. 122-126.) New York. Size 10 × 6½. *Presented by the Author.*

Syria—Palestine. **Macgregor.**
The *Rob Roy* on the Jordan. A Canoe Cruise in Palestine, Egypt, and the Waters of Damascus. By John Macgregor, M.A. [Eighth Edition.] London: John Murray, 1904. Size 8 × 5½, pp. xiv. and 428. *Maps and Illustrations. Price* 2*s.* 6*d. net. Presented by the Publisher.*

This is a welcome addition to the number of famous books of travel at popular prices. Both the type and paper and general get-up of the volume are alike good.

Turkey—Arabia. *Nineteenth Century* **56** (1904): 251-261. **Bacon.**
To explore Arabia by Balloon. By the Rev. J. M. Bacon.

Turkey—Arabia. *M.K.K.G. Ges. Wien* **47** (1904): 47-55. ——
Die Hedjaz-Eisenbahn.

AFRICA.

Algeria. **Lartigue.**
Monographie de l'Aurès. Par le Lieut.-Colonel de Lartigue. Constantine, 1904. Size 10 × 6½, pp. x. and 492. *Illustrations. Price* 13*s.* 6*d.*

An excellent piece of regional geography.

Central Africa. *Globus* **86** (1904): 5-13, 73-79. **Senftenberg.**
Zwei Reisen durch Ruanda 1902 bis 1903. Aus Tagebüchern, Briefen und hinterlassenen Papieren des Oberleutnants F. R. von Parish zusammengestellt von Oscar Freiherr Parish von Senftenberg. *With Map and Illustrations.*

Noticed in the Monthly Record, *ante*, p. 678.

Congo State. **Marès.**
Roland De Marès. The Congo. Brussels: J. Lebègue & Co., [1904]. Size 9 × 6, pp. 118.

A reply to criticisms of the State methods.

Congo State—Katanga. *B.S. d'Études Colon.* **11** (1904): 576-600. **Tonneau.**
Le Katanga. Par E. Tonneau.

A general account of the operations of the Katanga Company, and the economic conditions of the country.

East Africa—Masai. **Merker.**
Die Masai. Ethnographische Monographie eines ostafrikanischen Semitenvolkes. Von M. Merker. Berlin: D. Reimer (Ernst Vohsen), 1904. Size 11 × 8, pp. xvi. and 422. *Map and Illustrations. Price* 8*m. Presented by the Publisher.*

The most thorough account of the Masai that has yet appeared. The author had many opportunities of becoming acquainted with the people when serving as an officer in the military forces of the German protectorate.

Egypt. *Scottish G. Mag.* **20** (1904): 318-354. **White.**
The Rehabilitation of Egypt. By A. S. White.

Egypt—Zoology. **Jagerskiöld.**
Results of the Swedish Zoological Expedition to Egypt and the White Nile, 1901, under the direction of L. A. Jägerskiöld. Part i. Uppsala: C. J. Lundström, 1904. Size 10 × 6½. *Illustrations. Presented by the Royal University of Uppsala.*

French Congo. *Mouvement G.* **21** (1904): 337-340. **Villelongue.**
L'entre-Ubangi-et-Sanga. Par P. de Villelongue. *With Map.*

Describes the exploration of the Motaba, a western tributary of the Ubangi.

French West Africa. *B.S.G. Marseille* **28** (1904): 43-54. **Barot.**
L'Afrique Occidentale française, son passé, son avenir, conférence du Docteur Barot. *With Map.*

German South-West Africa. *Deutsch. Kolonialzeitung* 21 (1904): 248. **Groll.**
Die Notwendigkeit einer Triangulation in Deutsch-Südwestafrika. Von M. Groll.

Gold Coast. *J. African S.* 3 (1904): 325–351. **Nathan.**
Dutch and English on the Gold Coast in the Eighteenth Century. By Major Sir M. Nathan.

Ivory Coast. **Croson-Duplessix.**
Renseignements Colon.. Comité l'Afrique Française, No. 6. (1904): 152–156.
Notes Ethnographiques sur la Côte-d'Ivoire. Par Capitaine Croson-Duplessix.

Kamerun. *Globus* 86 (1904): 1–5. **Hutter.**
Völkergruppierung in Kamerun. Von Hauptmann a. D. Hutter. *With Map.*

Lagos, etc. *J. African S.* 3 (1904): 464–481. **MacGregor.**
Lagos, Abeokuta and the Alake. By Sir W. MacGregor.

Madagascar—Railway. *Rev. Madagascar* 6 (2) (1904): 28–37. **Delhorbe.**
Le chemin de fer de Madagascar. Par C. Delhorbe.

Morocco. *Fortnightly Rev.* 76 (1904): 423–436. **Bensusan.**
In Red Marrakesh. By S. L. Bensusan.

Mozambique. **Negreiros.**
Le Mozambique. Par A. Negreiros. Paris: A. Challamel, 1904. Size 7½ × 5½, pp. 198. *Map and Illustrations. Presented by the Author.*

Natal—Durban. **Henderson.**
Durban: Fifty Years' Municipal History. Compiled for the Durban Corporation in Celebration of the Jubilee of the Borough, by W. P. M. Henderson. Durban: Robinson & Co., 1904. Size 10 × 6½, pp. 394. *Illustrations. Presented by the Town Clerk, Durban.*

The history of Durban as a municipality dates from 1854.

Nigeria. **Hazzledine.**
The White Man in Nigeria. By G. D. Hazzledine. London: E. Arnold, 1904. Size 9 × 6, pp. xiv. and 228. *Map and Illustrations. Price 10s. 6d. net. Presented by the Publisher.*

A thoughtful study of present conditions and future prospects in Nigeria. The author is sanguine as to the latter.

Nigeria. *Blackwood's Mag.* 176 (1904): 329–337. **Partridge.**
The Burial of the Atta of Igaraland, and the "Coronation" of his successor. By C. Partridge.

Nile. *B. American G.S.* 36 (1904); 346–352. **Chaillé-Long.**
Chaillé-Long's Work on the Nile. *With Map.*

The writer lays stress on the value of his work under Gordon on the Upper Nile, and protests against the disuse of the name Ibrahim given by him to Lake Choga.

North Africa. *C. Rd.* 138 (1904): 1629-1631. **Bureau.**
Le terrain houiller dans le nord de l'Afrique. Note de E. Bureau.

The proofs of the existence of carboniferous strata in North Africa, which have been slowly accumulating since Barth's time, have lately received a further addition through the investigations of Lieut. Poirmeur in south-west Algeria.

North Africa. **El-Hachaichi.**
Voyage au Pays des Senoussia à travers la Tripolitaine et les Pays Touareg. Par le Cheikh Mohammed ben Othmane El-Hachaichi traduit par V. Serres et Lasram. Paris: A. Challamel, 1903. Size 7½ × 5, pp. 316. *Portrait. Price 3s.*

This journey by an Arab sheikh was undertaken in 1896 at the instance of the Marquis de Mores, then setting out on his last ill-fated expedition. It led to the Senussi centre of Kufra, and is interesting from the information it gives of the position of the sect at that time, as well as of the northern Tuareg countries.

North and West Africa. *B.S. Languedoc. G.* 27 (1904): 131–143. **Bordier.**
La voie transafricaine de Tunisie à Loango par le Tchad. Par le Commandant Bordier.

On the need of opening a through route from north to south of French Africa.

Sahara. *C. Rd.* 138 (1904): 1527-1529. **Foureau.**
Découverte de gîtes fossilifères dans le Djoua, à l'est de Timassânine (Sahara). Note de F. Foureau. *With Map.*

Sahara. *C. Rd.* 138 (1904): 1529-1531. **Haug.**
Sur la faune des couches à *Ceratodus* cretacées du Djoua, près Timassâniue (Sahara). Note de E. Haug.

Sahara. **Normand.**
Renseignements Colon., Comité l'Afrique Française, No. 7 (1904): 165-170.
Les Travaux de la vallée de la Zousfana. Par Capitaine R. Normand.

On works carried out since the French occupation.

Togo. *Deutsch Kolonialblatt* 15 (1904): 487-488. **Seefried.**
Bericht des Oberleutnants Freiherrn v. Seefried über die Untersuchung des Hahoflusses. *With Map.*

Tunis. *Questions Dipl. et Colon.* 18 (1904): 81-90. **Lorin.**
Études tunisiennes. L'évolution politique du protectorat. Par H. Lorin.

Tunis. ——
La Tunisie au début du XX^{me} siècle. Paris: F. R. de Rudeval, 1904. Size 10 × 6½, pp. viii. and 378. *Illustrations. Price* 12*s.* 6*d.*

This is produced on the same lines as the similar work on Madagascar which appeared in 1902. The separate monographs are by experts in their special subjects, and the work is the best account of Tunis for general reference that has yet appeared.

Uganda. ——
Africa, No. 11 (1904). Final Report of the Uganda Railway Committee. London: Eyre & Spottiswoode, 1904. Size 13½ × 8½, pp. 32. *Price* 4*d.*

Upper Nile Basin. **Garstin and Dupuis.**
Report upon the Basin of the Upper Nile, with proposals for the improvement of that river, by Sir W. Garstin, G.C.M.G., to which is attached a report upon Lake Tsana and the rivers of the Eastern Soudan by Mr. C. Dupuis. With Maps and Appendices. Cairo, 1904. Size 13½ × 9, pp. vi., 196, 56, and 42. *Maps and Illustrations.* [2 *copies.*] *Presented by the Survey Department, Cairo.*

To be reviewed.

West Africa. *B. Comité l'Afrique Française* 14 (1904): 228-229. **Maistre.**
A propos du Toubouri-Kabbi. Par C. Maistre.

Calls attention to Captain Loefler's part in the exploration of the Tuburi, which has been strangely left out of view by writers who have dealt with Captain Lenfant's recent expedition.

NORTH AMERICA.

Alaska. *B. United States Geolog. Surv., No.* 218 (1903): pp. 72. **Collier.**
The Coal Resources of the Yukon, Alaska. By A. J. Collier. *With Maps and Plates.*

Alaska—Lake Clark. *National G. Mag.* 15 (1904): 326-331. **Osgood.**
Lake Clark, a little-known Alaskan Lake. By W. H. Osgood. *With Map and Illustrations.*

Canada. *American J. Sci.* 18 (1904): 175-179. **Chalmers.**
The Geomorphic Origin and Development of the Raised Shore Lines of the St. Lawrence Valley and Great Lakes. By Dr. R. Chalmers.

Canada. *T.R.S. Canada* 9 (Sec. IV.) (1903): 143-147. **Poole.**
A Submerged Tributary to the Great Pre-Glacial River of the Gulf of St. Lawrence. By Dr. H. S. Poole. *With Map.*

Canada. ——
Annual Report of the Department of the Interior for the year 1902-1903. [Ottawa], 1904. Size 10 × 6½. *Illustrations.*

The report of the Surveyor-General states that sixty-six parties were at work in 1903. Among the special reports of geographical interest are those on surveys along the proposed route of the Canadian Northern Railway.

Canada—Bibliography. **Wrong and Langton.**
Review of Historical Publications relating to Canada. Edited by G. M. Wrong and H. H. Langton. Vol. viii. Publications of the year 1903. The University of Toronto, 1904. Size 11 × 7½, pp. xii. and 226.

Canada—British Columbia. **Mullius.**

The Stickeen River Country. By C. F. Mullius. Moose, Caribou and Big Horn Sheep Hunting in Cassiar District, B.C. (Reprinted from *Western Field*, February, March, and April, 1904.) Size 6 × 8, pp. 48. *Illustrations.* *Presented by the Author.*

Canada—British Columbia. ——

All-Canadian Railway to the North. Description of the Central Route *via* North Thompson Valley and Cariboo. Issued by the Inland Board of Trade, Kamloops, B.C. Size 8 × 6, pp. 12. *Presented by M. S. Wade, Esq.*

Canada—British Columbia. ——

The Great Interior of British Columbia. Description of a Portion of the Interior Valley to be traversed by the Boundary Kamloops and Cariboo Central Railway. (Reprinted from *Inland Sentinel*, Kamloops, B.C.) Size 8 × 6, pp. 8. *Presented by M. S. Wade, Esq.*

Canada—British Columbia—Lepidoptera. **Dyar.**

P. United States National Museum **27** (1904): 779-938.

The Lepidoptera of the Kootenai District of British Columbia. By H. G. Dyar.

Canada—Geological Survey. ——

Summary Report of the Geological Survey Department of Canada for the Calendar Year 1903. Ottawa, 1904. Size 10 × 6½, pp. 218. *Maps and Sections.* *Presented by the Geological Survey of Canada.*

Contains much information on the mineral resources of various parts of the Dominion, and reports on topographical surveying in Keewatin and elsewhere.

Canada—Turtle Mountain. *B. American G.S.* **36** (1904): 272-275. ——

The Great Landslide on Turtle Mountain. *With Illustrations.*

United States. **Baedeker.**

The United States, with an Excursion into Mexico. Handbook for Travellers by Karl Baedeker. Third Edition. Leipzig: K. Baedeker, 1904. Size 6½ × 4½, pp. civ. and 660. *Maps and Plans.* *Price* 12*m.* *Presented by the Publisher.*

Carefully brought up to date. The maps, which have been prepared under the supervision of Mr. Henry Gannett, include six, as well as eight plans, which now appear for the first time.

United States—Arizona. **Ransome.**

Geology of the Globe Copper District, Arizona. By F. L. Ransome. (United States Geological Survey, Professional Paper No. 12.) Washington, 1903. Size 11½ × 9, pp. 168. *Maps and Illustrations.* *Presented by the U.S. Geological Survey.*

United States—Arizona. **Ransome.**

The Geology and Ore Deposits of the Bisbee Quadrangle, Arizona. By F. L. Ransome. (United States Geological Survey, Professional Paper No. 21.) Washington, 1904. Size 11½ × 9, pp. 168. *Maps and Illustrations.* *Presented by the U.S. Geological Survey.*

United States—Census. ——

[Twelfth Census of the United States, 1900.] Special Reports. Occupations. Washington, 1904. Size 12 × 9½, pp. cclxvi. and 764. *Diagrams.*

United States—Clays. **Ries.**

The Clays of the United States, East of the Mississippi River. By H. Ries. (United States Geological Survey, Professional Paper, No. 11.) Washington, 1903. Size 11½ × 9, pp. 298. *Maps and Illustrations.* *Presented by the U.S. Geological Survey.*

United States—Climatology. *G. Teacher* **2** (1904): 212-218. **Ward.**

The Climatology of the United States: an Outline. By R. de C. Ward.

United States—Colorado. **Girty.**

The Carboniferous Formations and Faunas of Colorado. By G. H. Girty. (United States Geological Survey, Professional Paper No. 16.) Washington, 1903. Size 11½ × 9, pp. 546. *Plates.* *Presented by the U.S. Geological Survey.*

United States—Great Salt Lake. *Scottish G. Mag.* **20** (1904): 424-427. **Talmage.**

Salt Lake Water. By Prof. J. E. Talmage.

United States—Historical. **Gass and Hosmer.**

Gass's Journal of the Lewis and Clark Expedition. By Sergeant Patrick Gass, one of the persons employed in the expedition. Reprinted from the edition of 1811, with facsimiles of the original title-page and the five original illustrations, a reproduction of a rare portrait of Gass, and a map of the Lewis and Clark route. With an analytical Index, and an Introduction by J. K. Hosmer, LLD. Chicago: A. C. McClurg & Co., 1904. Size 8¼ × 6¼, pp. liv. and 298. *Price* $3.50 *net.*

Gass's journal is of value as supplying antindependent version of Lewis and Clark's great journey, supplementing and confirming the official narrative. The reprint is welcome, as the original is now scarce.

United States—Historical. **Lewis and Clark, and Wheeler.**

The Trail of Lewis and Clark, 1804–1904. A story of the great exploration across the continent in 1804–06; with a description of the old trail, based upon actual travel over it, and of the changes found a century later. By O. D. Wheeler. 2 vols. New York and London: G. P. Putnam's Sons, 1904. Size 8¾ × 6, pp. (vol. i.) xxiv. and 378; (vol. ii.) xvi. and 420. *Maps and Illustrations. Price* 25*s. net.*

A very complete history of the organization and execution of Lewis and Clark's great enterprise, with elucidations from the writer's personal acquaintance with the route.

United States—Maine. *B. Geolog. S. America* 12 (1900): 433–448. **Tarr.**

Glaciation of Mount Ktaadn, Maine. By R. S. Tarr. *With Plates.*

United States—Massachusetts—Boston. ———

Engineering Department. List of Maps of Boston published between 1600 and 1903, copies of which are to be found in the possession of the City of Boston or other collectors of the same. Reprint of Appendix I., Annual Report of the City Engineer, February 1, 1903. Boston, 1903. Size 9 × 6, pp. 248. *Presented by the Engineering Department, Boston.*

United States—Massachusetts—Salem. **Rantoul.**

Essex I. Hist. Collections 40 (1904): 201–211.

The Date of the Founding of Salem. By R. S. Rantoul. *With Plate.*

United States—Michigan. *J. Geology* 12 (1904): 326–334. **Bowman.**

A typical case of Stream-capture in Michigan. By I. Bowman. *With Map and Illustrations.*

United States—Mississippi. *Popular Sci. Monthly* 65 (1904): 318–322. **Kingery.**

Saving the Mississippi's Source. By H. M. Kingery. *With Maps.*

Urges the need of saving the tract at the source of the Mississippi from the devastation caused by lumber-getting.

United States—Nebraska. **Darton.**

Preliminary Report on the Geology and Water Resources of Nebraska West of the One Hundred and Third Meridian. By N. H. Darton. (United States Geological Survey, Professional Paper No. 17.) Washington, 1903. Size 11½ × 9, pp. 70. *Maps and Illustrations. Presented by the U.S. Geological Survey.*

United States—Negroes. ———

Department of Commerce and Labour, Bureau of the Census. Bulletin 8. Negroes in the United States. Washington, 1904. Size 12 × 9, pp. 334. *Maps.*

United States—New York. *J. Geology* 12 (1904): 281–289. **Kindle.**

A series of gentle folds on the border of the Appalachian system. By E. M. Kindle. *With Map.*

United States—New York. *B. American G.S.* 36 (1904): 257–264. **Symons.**

The Projected New Barge Canal of the State of New York. By Colonel T. W. Symons. *With Map.*

United States—Washington. **Smith and Willis.**

Contributions to the Geology of Washington. Geology and Physiography of Central Washington, by G. O. Smith. Physiography and Deformation of the Wenatchee-Chelan District, Cascade Range, by B. Willis. (United States Geological Survey, Professional Paper No. 19.) Washington, 1903. Size 12 × 9, pp. 102. *Maps and Illustrations. Presented by the U.S. Geological Society.*

CENTRAL AND SOUTH AMERICA.

Argentine Republic. *An. Museo. Nac. Buenos Aires* 10 (1904): 1–15. **Outes.**

Arqueologia de Hucal (Gobernación de la Pampa). Por F. F. Outes. *With Illustrations.*

Argentine Republic and Bolivia. *Deutsch. Rundschau G.* **27** (1904): 13–21. **Herrmann.**
Durch die Argentinische Puna zum Bolivianischen Chaco. Von W. Herrmann. *With Illustrations.*

Panama Canal. *G.Z.* **10** (1904): 297–316. **Wegener.**
Der Panama-Kanal. Von Dr. G. Wegener.

South America—Historical. **Akers.**
A History of South America, 1854–1904. By C. E. Akers. London: John Murray, 1904. Size 9½ × 6, pp. xxviii. and 696. *Maps and Illustrations. Price* 21*s. net. Presented by the Publisher.*

The kaleidoscopic character of South American occurrences during the past half-century renders this attempt to summarize the history of the several states during that period a most useful undertaking, which the author appears to have carried out with success.

Venezuela. **Goiticoa.**
Venezuela: Geographical Sketch, Natural Resources, Laws, Economic Conditions, Actual Development, Prospects of Future Growth. Edited and compiled for the International Bureau of the American Republics by N. V. Goiticoa. 1904. Washington, 1904. Size 9 × 6, pp. 608. *Map and Illustrations. Presented by the Bureau.*

A useful and comprehensive summary of existing knowledge.

Venezuela—Historical. **Humbert.**
La Première occupation Allemande du Vénézuéla au XVI^e^ siècle, période dite des Welser (1528–1556). Par J. Humbert. (Extrait du *Journal de la Société des Américanistes de Paris*, N.S. t. 1, No. 3.) 1904. Size 11½ × 8, pp. 14. *Plan.*

AUSTRALASIA AND PACIFIC ISLANDS.

Australasia. *Deutsch. Rundschau G.* **26** (1904): 460–463. **Umlauft.**
Fortschritte der geographischen Forschungen und Reisen im Jahre 1903. 1. Australien und die Südsee. Von Dr. F. Umlauft.

German New Guinea. **Schnee.**
Bilder aus der Südsee. Unter den Kannibalischen Stämmen des Bismarck-Archipels. Von Dr. H. Schnee. Berlin: D. Reimer (Ernst Vohsen), 1904. Size 8½ × 6, pp. xiv. and 394. *Map and Illustrations. Price* 14*s.*

A valuable addition to our knowledge of German New Guinea and neighbouring islands, where the author held an official post for two years. He visited some little-known parts of the possession, including the Admiralty and St. Matthias islands, and here puts down his experiences and observations.

Marianne Islands—Guam. *B. American G.S.* **36** (1904): 385–395. **Cox.**
The Island of Guam. By L. M. Cox. *With Map and Illustrations.*

Marshall Islands—Jaluit. *Globus* **85** (1904): 329–333, 352–356, 363–367. **Schnee.**
Zur Geologie des Jaluit-Atolles. Von Dr. Schnee. *With Map and Illustrations.*

New Guinea—Dutch. **Dissel.**
Tijds. K. Ned. Aard. Genoots. Amsterdam **21** (1904): 617–650.
Reis van Ati ati onin over Patipi en Degen naar Kajoni. Door J. S. A. van Dissel.

On a journey made in 1902 with a view to determining the limits of the Kapau-Papuan language, and to the study of the colonists from Ceram settled for two centuries in Western New Guinea.

New South Wales—Fisheries. ——
Fisheries of New South Wales. Annual Report for 1902. II. Fisheries Investigations and Fish Culture. [Sydney, 1904.] Size 13 × 8½, pp. 44. *Map, Diagrams, and Illustrations.*

Solomon Islands. **Ribbe.**
Zwei Jahre unter den Kannibalen der Salomo-Inseln. Reiseerlebnisse und Schilderungen von Land und Leuten. Von Carl Ribbe. Dresden-Blasewitz: H. Beyer, 1903. Size 10½ × 7, pp. viii. and 352. *Maps and Illustrations. Price* 10*s.* 6*d.*

Contains some valuable information on one of the least-known parts of the Pacific. About 150 pages deal with the Shortland islands, of the natives of which the author gives the fullest account that has yet appeared.

Tobi Island. *Globus* 86 (1904): 13–15. **Seidel.**
Tobi in Westmikronesien, eine deutsche Insel mit acht Namen. Von H. Seidel.

Victoria. **Turner.**
A History of the Colony of Victoria from its Discovery to its absorption into the Commonwealth of Australia. By H. G. Turner. 2 vols. London: Longmans & Co., 1904. Size 9 × 6, pp. (vol. i.) xvi. and 396; (vol. ii.) x. and 390. *Map and Plan. Price 21s. Presented by the Publishers.*

Valuable as an attempt to present the annals of Victoria by one who has lived half a century in the colony, and has taken great pains to obtain the testimony of authentic records, if not of the actors themselves, in the case of the earlier events.

POLAR REGIONS.

Franz Josef Island—Fossil Flora. **Laubach.**
K. Svensk. Vet.-A. Handl. 37 (No. 7) (1904): pp. 16.
Die strukturbietenden Pflanzengesteine von Franz Josef Land. Von H. Grafen zu Solms Laubach. *With Plates.*

MATHEMATICAL GEOGRAPHY.

Cartography—Projection. *Petermanns M.* 50 (1904): 155–159. **Van der Grinten.**
Darstellung der ganzen Erdoberfläche auf einer Kreisförmigen Projektionsebene. Von A. J. van der Grinten. *With Maps.*

Describes a useful projection by which the general relations of the continents and oceans can be well shown in a single plane map. While avoiding the great exaggeration of the north and south caused by Mercator's projection, it does not entirely avoid it. Thus Greenland appears nearly as large as South America (see *ante*, p. 670).

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Earthquakes. **Dutton.**
Earthquakes, in the Light of the New Seismology. By C. E. Dutton. London: J. Murray, 1904. Size 8½ × 6, pp. xxiv. and 314. *Maps and Illustrations. Price 6s. net. Presented by the Publisher.* [To be reviewed.]

Geophysics. *Geolog. Mag.* 1 (1904): 495–497. **Fisher.**
On the Cause of Compression of the Earth's Crust. By the Rev. O. Fisher.

Hydrography. **Murphy, Hoyt, and Hollister.**
Hydrographic Manual of the United States Geological Survey. Prepared by E. C. Murphy, J. C. Hoyt, and G. B. Hollister. (United States Geological Survey, Water-supply and Irrigation Paper No. 94.) Washington, 1904. Size 9½ × 6, pp. 76. *Presented by the U.S. Geological Survey.*

Hydrology. *Monthly Weather Rev.* 32 (1904): 176–177. **Loveland.**
Increased flow of spring water in the autumn. By G. A. Loveland.

Meteorology—Dust-fall. **Meinardus.**
Ueber einige bemerkenswerte Staubfälle der letzten Zeit. Von Dr. W. Meinardus. (Sonder-Abdruck aus "Das Wetter," Heft 12, 1903.) Size 9½ × 6½, pp. 16. *Presented by the Author.*

Meteorology—Pressure. *Meteorolog. Z.* 21 (1904): 345–357. **Ekholm.**
Wetterkarten der Luftdruckschwankungen. Von N. Ekholm. *With Diagrams.*

Meteorology—Pressure. *P.R.S.* 73 (1904): 457–470. **Lockyer.**
The Behaviour of the Short-Period Atmospheric Pressure Variation over the Earth's Surface. By Sir N. Lockyer, K.C.B., etc., and W. J. S. Lockyer. *With Diagrams.*

Meteorology—Winds. **Marchi.**
Atti R.A. Lincei, Rendiconti 13 (1 Sem.) (1904): 619–626.
La circolazione atmosferica negli strati inferiori. Nota di L. De Marchi.

Meteorology—Winds. *P.R.S.* 74 (1904): 20–30. **Shaw.**
On the General Circulation of the Atmosphere in Middle and Higher Latitudes. By W. N. Shaw, F.R.S. *With Diagrams.*

Meteorology—Winds. *Ann. Hydrographie* 32 (1904): 408–415. **Wegemann.**
Erweiterung des barischen Windgesetzes nebst Anwendungen. Von Dr. Wegemann. *With Diagram.*

Oceanography. **Macallum.**
University of Toronto Studies, Physiolog. Ser., No. 5 (1904): pp. 30.
The Palæochemistry of the Ocean in relation to Animal and Vegetable Protoplasm. By A. B. Macallum.

Oceanography. *Naturw. Wochenschrift* 3 (1904): 705–713. **Schütt.**
Kosmologie als Ziel der Meeresforschung. Von Prof. Dr. F. Schütt.

Oceanography—Azores. *C. Rd.* 138 (1904): 1643-1644. **Thoulet.**
Océanographie de la région des Açores. Note de M. Thoulet.

Oceanography—Azores. *C. Rd.* 139 (1904): 241–243. **Thoulet.**
La fosse de l'Hirondelle, dans l'Archipel des Açores. Note de M. Thoulet. *With Illustration.*

Results of observations during the latest cruise of the Prince of Monaco.

Oceanography—Pacific Ocean. *Science* 20 (1904): 338–341. **Bishop.**
The Cold-current System of the Pacific, and Source of the Pacific Coast Current. By Rev. S. E. Bishop. *With Diagram.*

Physiography. **Huxley and Gregory.**
Physiography, an Introduction to the Study of Nature. By T. H. Huxley. Revised and partly rewritten by R. A. Gregory. London: Macmillan & Co., 1904. Size 7 × 5, pp. xii. and 424. *Illustrations. Price 4s. 6d. Presented by the Publishers.* [To be reviewed.]

Ripple-marks. *Geolog. Mag.* 1 (1904): 410–418. **Hunt.**
The Descriptive Nomenclature of Ripple-mark. By A. R. Hunt.

Volcanoes. *Globus* 86 (1904): 182–185. **Krebs.**
Beziehungen des Meeres zum Vulkanismus. Von W. Krebs. II. Die Verbreitung der seebebenartigen Erscheinungen, mit besonderer Berücksichtigung der Erdbebenfluten. *With Maps.*

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Communications. *S.R. Belge G.* 28 (1904): 36–61, 110-132, 225-243. **Cammaerts.**
J. G. Kohl et la Géographie des Communications. Par Em. Cammaerts.

Traces the part played by Kohl in the evolution of the modern conception of geography as the study of the influence of environment.

Historical. *B.S.G. Lisboa* 22 (1904): 121-126. **Garofalo.**
I progressi delle conoscenze geografiche nell' età detta Ellenistica. Pelo Prof. F. P. Garofalo.

Historical—Cabot. *T.R.S. Canada* 9 (Sec. II.) (1903): 205–215. **Howley.**
Latest Lights on the Cabot Controversy. By Rt. Rev. Bishop M. F. Howley. *With Map.*

Historical Geography. **Götz.**
Historische Geographie, Beispiele und Grundlinien. Von Dr. W. Götz: (Die Erdkunde, herausgegeben von M. Klar. XIX. Teil.) Leipzig und Wien: F. Deuticke, 1904. Size 10½ × 7, pp. x. and 294.

Rather a collection of object lessons than a complete treatise, as the only two groups of countries dealt with are those of the Mediterranean and Central Europe.

Negro Race. *J. African S.* 3 (1904): 398-404. **Johnston.**
A Negro Exodus. By A. Johnston.

On a possible return movement from the United States.

Political—Anglo-French Agreement. ——
Deutsch. Rundschau G. 26 (1904): 465–466.
Das Französisch-englische Abkommen vom 8. April, 1904. *With Map.*

BIOGRAPHY.

Celsius. *Deutsch. Rundschau G.* 26 (1904): 519-520. ——
Anders Celsius. *With Portrait.*

Norden. *London Topographical Record* 2 (1903): 42–65. **Wheatley.**
Notes upon Norden and his map of London, 1593. By Henry B. Wheatley, F.S.A. Reprinted from the *Transactions* of the New Shakespere Society.

Rasles. *T.R.S. Canada* 9 (Sec. I.) (1903): 117–134. **Dionne.**
Le Père Sébastien Rasles, jésuite, missionnaire chez les Abénaquis, 1657–1724. Par Dr. N. E. Dionne.

Ratzel. *B. American G.S.* 36 (1904): 550–553. **Genthe and Semple.**
Tributes to the Friedrich Ratzel. By Mrs. M. K. Genthe and Miss E. C. Semple. *With Portrait.*

GENERAL.

Bible Society. ———
After a Hundred Years. A Popular Illustrated Report of the British and Foreign Bible Society for the Centenary Year 1903–4. London: The Bible House, 1904. Size 8½ × 5½, pp. 124. *Illustrations. Presented by the British and Foreign Bible Society.*

Educational. *G. Anzeiger* 5 (1904): 150–153. **Schwarz.**
Die Ansichtskarte im Geographieunterricht. Von Dr. S. Schwarz.

Educational. **Gregory.**
The Teaching of Geography expanded from a Lecture by J. W. Gregory, D.SC., F.R.S. Melbourne: Whitcombe & Tombs, [1902]. Size 7½ × 5, pp. 50. *Illustration.*

Educational. *G. Teacher* 2 (1904): 191–197. **Mackinder.**
The Development of Geographical Teaching out of Nature Study. By H. J. Mackinder.

Educational—Textbook. **Dodge.**
Dodge's Elementary Geography. By R. E. Dodge. Chicago, etc.: Rand, McNally & Co., [1904]. Size 10 × 8½, pp. 232. *Maps and Illustrations. Presented by the Publishers.*

Education—Botanical Geography. *G. Teacher* 2 (1904): 201–211. **Moss.**
Botanical Geography for Schools. By C. E. Moss, B.SC. *With Illustrations.*

The writer does good service in calling attention to the value for educational purposes of a study hitherto almost entirely neglected in schools.

Geographical Terms. **Knox.**
Glossary of Geographical and Topographical Terms and of words of frequent occurrence in the composition of such terms and of place-names. By A. Knox. (Stanford's 'Compendium of Geography and Travel' (Supplementary volume).) London: E. Stanford, 1904. Size 8 × 5½, pp. xl. and 432. *Price* 15*s*. *Presented by the Publisher.* [To be reviewed.]

Geography. **Dryer.**
What is Geography? C. R. Dryer. From the *Teacher's Journal*, Marion, Indiana, [1903]. Size 9½ × 6½, pp. 14.

This is referred to at p. 421, *ante*.

Japanese Grammar. **Weintz.**
Japanese Grammar Self-taught. (In Roman Character.) With Phrases and Idioms. By H. J. Weintz. London: E. Marlborough & Co., 1904. Size 7½ × 5, pp. 184. *Price* 5*s*. *Presented by the Publishers.*

Lemuria. **Scott-Elliot.**
The Lost Lemuria. With two maps showing distribution of land areas at different periods. By W. Scott-Elliot. London: Theosophical Publishing Society, 1904. Size 9½ × 6, pp. 44. *Price* 2*s*. 6*d*. *net. Presented by the Publishers.*

An extraordinary jumble of Theosophical jargon with scientific facts borrowed from recognized authorities.

Library Catalogue. ———
Catalogue of the Books, Manuscripts, Maps, and Drawings in the British Museum (Natural History). 2 vols. (A–K). London: Longmans & Co., 1903–1904. Size 11½ × 9, pp. viii. and 1038. *Presented by the Trustees of the British Museum.*

When complete, this will be a valuable aid to bibliography, and is of interest to the geographer, from the large number of works bearing on his science which it includes. It gives, under one alphabet, both names of authors and publications of learned societies, etc., but "separates" from these are only entered in the case of monographs of special importance. The stringency of this rule might perhaps have, with advantage, been more often relaxed. Thus we should have expected to find the valuable monographs forming Engler and Drude's 'Vegetation der Erde' separately catalogued, but this is not the case.

Travel. **Boehm.**

The Persian Gulf and South Sea Isles. By Sir E. C. Boehm, Bart. London: H. Cox, 1904. Size 9 × 5½, pp. xii. and 180. *Illustrations. Price 6s. Presented by the Publisher.*

Travel. **Thomson.**

Round the World, including Appendices. By J. P. Thomson, LL.D. Brisbane: the Outridge Printing Co., 1904. Size 10 × 6½, pp. xxviii. and 358. *Map and Illustrations. Presented by the Author.*

The tour included visits to the United States, Canada, Great Britain, the Rhine, France, and the Suez Canal. The appendices consist of reprints of papers on the Physical Geography of Australia and on Queensland.

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

Baden. **Konigl. Preuss. Landes-Aufnahme.**

Uebersichtskarte von Baden. Scale 1 : 200,000 or 3·2 stat. miles to an inch. Bearbeitet in der Kartogr. Abteilung der Königl. Preuss. Landes-Aufnahme 1903–4. 6 sheets. *Price* 1.50*m. each sheet.*

Belgium. **Institut Cartographique Militaire.**

Carte des chemins de fer, routes et voies navigables de la Belgique. Scale 1 : 320,000 or 5 stat. miles to an inch. Publiée par l'Institut Cartographique Militaire, 1904.

Shows principal roads, railways, canals, etc., up to date. The map is also ruled into squares indicating the limits of the sheets on the large-scale 1 : 20,000 Government map of Belgium. It is printed in colours.

England and Wales. **Ordnance Survey.**

ORDNANCE SURVEY OF ENGLAND AND WALES:—Sheets published by the Director-General of the Ordnance Survey, Southampton, from October 1 to 31, 1904.

2 miles to 1 inch:—

With hills, and printed in colours, 51, 52, 1*s. each;* folded in cover or flat in sheets.

1-inch:—

(Third edition) in outline, 12, 15, 236, 256; 1*s. each.* (Engraved.)
(Third edition) printed in colours, 284, 285, 1*s. each.*
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United Kingdom. **Geological Survey.**

Summary of Progress for 1903. 1*s.*
(*E. Stanford, London Agent.*)

Germany. **Königl. Preuss. Landes-Aufnahme.**

Karte des Deutschen Reiches. Scale 1:100,000 or 1·6 stat. mile to an inch. Sheet 239, Salzwedel. Herausgegeben von der Kartogr. Abteilung der Königl. Preussische Landes-Aufnahme, 1904. *Price* 1.50*m. each sheet.*

Great Britain. **Woodward.**

Stanford's Geological Atlas of Great Britain, with plates of characteristic fossils. Preceded by a Description of the Geological Structure of Great Britain and its counties; and of the features observable along the principal lines of railway. By Horace B. Woodward, F.R.S., F.G.S. London: Edward Stanford, 1904. *Price* 12*s.* 6*d. net. Presented by the Publisher.*

It is now forty-four years since the first edition of Reynold's Geological Atlas, prepared with the assistance of Prof. John Morris, was published; and although the work was revised by Mr. Robert Etheridge in 1889, and a revised edition issued, the Geological Survey and other geological investigations have made considerable progress since that date. Mr. Stanford has now brought out a geological atlas of Great Britain, based upon and following much the same lines as the previous useful work, and the fact that the preparation of it has been entrusted to Mr. Horace B. Woodward is sufficient guarantee of its thoroughness and general merit. The maps of the original atlas were based to a large extent on those of the Geological Survey, and they have been revised as far as the scale has permitted, from later maps of the same survey, and from Sir Archibald Geikie's Geological Map of Scotland. The text has been entirely re-written; fuller descriptions of the geological formations and lists of localities for fossils have been given. Whilst a few of the original text-illustrations have been retained, most of these are fresh, many being taken from other authorities, which are fully acknowledged.

Ireland. **Bartholomew.**

Bartholomew's "Quarter-inch to Mile" Map of Ireland. Reduced by permission from the Ordnance Survey. Sheet 6. Dublin and Athlone. Edinburgh: John Bartholomew & Co., [1904]. *Price* 2*s., mounted on cloth. Presented by the Publisher.*

Netherlands. **Beekman and Schuiling.**

Schoolatlas van Nederland en zijne Overzeesche Bezittingen. Door A. A. Beekman en R. Schuiling. Vierde Druk. Zutphen: W. J. Thieme & Cie. *Price* 2.90*f.*

This is a very good general atlas of the Netherlands and the Dutch colonial possessions, and its usefulness will doubtless extend beyond the schoolroom. A special feature is the clear manner in which the character of the land is indicated by colouring, in addition to which a considerable amount of information is given by various colours and symbols concerning dykes, canals, etc.

Oder. **Königl. Oderstrombauverwaltung, Breslau.**

Uebersichtskarte von dem Niederschlagsgebeit der Oder mit Darstellung der mittleren jährlichen Niederschlagshöhen aus den neuesten veröffentlichten Beobachtungen des hydrologischen Jahrzehnts. Scale 1: 600,000 or 9·4 stat. miles to an inch. Bearbeitet in der Königlichen Oderstrombauverwaltung in Breslau. Glogau: Carl Flemming, 1904.

The mean annual rainfall of the Oder basin is shown on this map by the usual blue tinting, of varying intensity, based upon observations taken at numerous stations, which are indicated, during a period of ten years from November 1, 1890, to October 31, 1900. Brown contours and small figures, showing at a glance the approximate height of land of any locality, are also given, and these are important in connection with the rainfall of any special district. The map has been carefully prepared, and will be of considerable service in connection with other material dealing with the rainfall of this part of Europe.

ASIA.

Arabia. **Bartholomew.**

Two maps showing the Orographical and Land Surface Features of Arabia. By J. G. Bartholomew, F.R.G.S. Scale 1 : 10,000,000 or 157·8 stat. miles to an inch. Edinburgh: John Bartholomew & Co., [1904]. *Presented by the Publisher.*

Asia Minor. **Kiepert.**

Karte von Kleinasien. Von Dr. Richard Kiepert. Scale 1 : 400,000 or 6·3 stat. miles to an inch. Sheets: D I. Budrum; B VI. Erzirum; C VI. Diarbekr. Berlin: Dietrich Reimer (Ernst Vohsen), 1904. *Price* 6*m.*

With the publication of the present part fifteen sheets of this map, out of a total of twenty-four, have appeared. It is evident, from an inspection of these important sheets, that Dr. Kiepert spares no pains to render his map as complete as possible, although much of the available information from which it has been compiled can only be of a very approximate character.

China. **Königl. Preuss. Landes-Aufnahme.**

Karte von Ost-China. Scale 1 : 1,000,000 or 15·8 stat. miles to an inch. Sheet: Sairussu. Kartographische Abtheilungen der Königl. Preussische Landes-Aufnahme, 1904. *Price* 1·50*m. each sheet.*

Dutch East Indies. **Stemfoort and Siethoff.**

Atlas der Nederlandsche Bezittingen in Oost-Indië, naar de niewste Bronnen samengesteld en aan de regeering opgedragen door J. W. Stemfoort en J. J. ten Siethoff, Kapiteins van den Generalen staf van het Nederlandsch-Indisch leger. Gereproduceerd, op last van het Departement van Koloniën, aan de Topographische inrichting te 'sGravenhage, onder leiding van den Directeur C. A. Eckstein. New edition. Sheets: 6, Noord Sumatra; scale 1 : 900,000 or 14·2 stat. miles to an inch, 1904. 9, Sumatra's Westkust; scale 1 : 600,000 or 9·5 stat. miles to an inch, 1903.

Persia. **Stahl.**

Geologische Karte von Karadag (Persien). Nach den Karten der Gesellschaft Gorinainoff und Enakieff und den geologischen Aufnahmen der Bergingenieure Kurmakoff und Iwanoff bearbeitet von A. F. Stahl, 1904. *Petermanns Geographische Mitteilungen*, Jahrgang 1904, Taf. 17. Gotha: Justus Perthes, 1904. *Presented by the Publisher.*

AFRICA.

Africa. **Intelligence Division, War Office**

Africa. Scale 1 : 1,000,000 or 15·8 stat. miles to an inch. Sheet 82, Fernando Po. *Price* 2*s.* Egyptian Sudan. Scale 1 : 250,000 or 3·9 stat. miles to an inch. Sheets: 46-J, Karora; 55-E, Kagmar; 55-H, Gedaref; 55-I, El Obeid; 55-K, Sennar; 55-L, Doka; 55-O, Karkoj; 56-A, Kassala; 56-I, Nogara. *Price* 1*s.* 6*d. each sheet.* Anglo-Egyptian Sudan. Compiled in the Intelligence Office, Khartum. May, 1904. Scale 1 : 4,000,000 or 63·1 stat. miles to an inch. (Index to the sheets of the 1 : 250,000 Series.) *Price* 1*s.* 6*d.* London: Intelligence Division, War Office, 1904.

Egypt. **Survey Department, Cairo.**

Provisional Map of Quena Province. Scale 1 : 50,000 or 1·3 inch. to a mile. 6 Sheets. Map of Lower Egypt and the Fayum. Scale 1 : 50,000 or 1·3 inch to a mile. Cairo: Public Works Ministry, Survey Department, 1904. *Presented by the Director-General, Survey Department, Cairo.*

German East Africa. **Sprigade.**

Karte der Gebiete am sudlichen Tanganjika- und Rukwa-See. Hauptsachlich nach den Aufnahmen des Hauptmann v. Prittwitz u. Gaffron und mit Benutzung unveröffentlicher Aufnahmen, sowie aller andtren veröffentlichten Materialien, bearbietet von P. Sprigade, gezeichnet von H. Nobiling. Scale 1 : 500,000 or 7·9 stat. miles to an inch. From the *Mitteilungen aus den deutschen Schutzgebieten*, Band xvii., 1904.

Includes that part of German East Africa lying between latitude 6° and 8° 50′ S. and longitude 30° to 34° E. In its compilation the route surveys of many German officials and others have been utilized, and the map is certainly the most complete that has hitherto been published of this special region. It is well executed and printed in colours.

St. Helena. **Intelligence Division, War Office.**

St. Helena. Scale 1 : 25,000 or 2·5 inches to one stat. mile. London: Intelligence Division, War Office, 1904. *Price 3s. Presented by the Intelligence Division, War Office.*

A very effective map of the island printed in four colours. Relief is shown by contour lines, at 100-feet intervals, and brown shading.

Togo. **Seefried.**

Aufnahme des Haho von Oberleutnant Freiherr von Seefried. Nach einer Originalconstruction des Oberleutnant Freiherr von Seefried im Masstabe 1 : 12,500 reduziert auf 1 : 100,000 durch den Geometer Arendt. From the *Deutsches Kolonialblatt*, 1904, No. 16.

The Haho is a small river in the German territory of Togo. This is a sketch-map merely showing the course of the river, with notes as to its breadth, amount of water, etc.

West Africa. **Sprigade.**

Karte der deutsche-englischen Grenze im Tschokossi-Mamprussi-Gebiet. Nach den Aufnahmen der deutschen Grenzkommissions-Mitglieder Graf Zech und Frhr. v. Seefried, 1902, bearbeitet von P. Sprigade. Scale 1 : 100,000 or 1·6 stat. miles to an inch. (From the *Mitteilungen aus den deutschen Schutzgebieten*, Band xvii., 1904.) *Presented by the Author.*

Shows the Anglo-German boundary-line between northern Togo and the northern territories of the Gold Coast, from recent surveys of the German Boundary Commissioners.

Zanzibar. **Zanzibar Government.**

A map of Zanzibar Island from surveys made by Imam Sherif Khan Bahadur, Survey of India, under the direction of the late General Sir Lloyd William Mathews, K.C.M.G. Scale 1 : 31,680 or 2 inches to a stat. mile. 10 Sheets. London: Edward Stanford, 1904. *Price 21s. Presented by Basil Cave, Esq., C.B.*

The survey of the island of Zanzibar, which forms the basis of this map, has been conducted by the well-known native Indian surveyor, Imam Sherif Khan Bahadur, who, after considerable experience on the Indian Government Survey, has in recent years done excellent work in other parts of Asia in connection with various exploring expeditions to which he has been attached. He is especially expert at plane-tabling, and his maps of parts of Arabia, made during the late Mr. Theodore Bent's expeditions, are well known. In 1896 he was granted one of the minor awards of the Royal Geographical Society for his excellent work. His surveys of Zanzibar, the results of which are embodied upon these two maps, constitute the first attempt at anything like a regular survey of the interior of the island on a large scale, and, although incomplete, it is decidedly a creditable piece of work. The map has been published on two scales, under the direction of the late General Sir Lloyd William Mathews, K.C.M.G., who held the office of prime minister to the Sultan.

AMERICA.

Canada. **Surveyor-General of Canada.**

Sectional Map of Canada. Scale 1 : 190,080 or 3 stat. miles to an inch. Fort Pitt sheet (63), West of Third Meridian, revised to September 2, 1904; Victoria sheet (80), West of Fourth Meridian, revised to September 2, 1904. Ottawa: Surveyor-General's Office, 1904. *Presented by the Surveyor-General of Canada.*

St. Lawrence Basin. **Bartholomew.**

Orographical map of the St. Lawrence Basin. By J. G. Bartholomew, F.R.G.S. Scale 1 : 5,000,000 or 78·9 stat. miles to an inch. Edinburgh: John Bartholomew & Co., [1904]. *Presented by the Publisher.*

In many parts the information from which this orographically coloured map has been prepared is necessarily extremely vague and approximate, especially in the northern regions. The actual area included is far greater than the St. Lawrence basin, which is clearly indicated by a red line.

GENERAL.

World. **Hartleben.**

A. Hartleben's Volks-Atlas enthaltend 72 Karten in Einhundert Kartenseiten. Vierte-Auflage. Lieferung 17. Vienna and Leipzig: A. Hartleben, [1904]. *Price 50 pf. each part.*

This part contains the following maps: Sheet 3 of a map of Germany on the scale of 1 : 1,350,000; map of North-West Africa on the scale of 1 : 12,000,000; map of the United States on the scale of 1 : 10,000,000.

World. **Petrie and Schokalsky.**

Marcks' Large General Table Atlas. Edited by Prof. E. J. Petrie and Colonel J. de Schokalsky. Part 9. St. Petersburg: A. F. Marcks, 1904. [In Russian.] *Presented by the Publisher.*

This part contains plates: 12, Ethnographic and linguistic map of Europe, scale 1 : 12,000,000; 33, West and Central Germany, scale 1 : 1,000,000; 36, Western Alps, scale 1 : 1,000,000; 49, Palestine, scale 1 : 700,000.

World. **Rinaudo.**

Atlante Storico per le Scuole Secondarie del Prof. Costanzo Rinaudo. Parte Terza: I Tempi Moderni, 28, Carte e Repertorio di tutti i nomi. Disegni del Cav. Domenico Locchi. Turin: G. B. Paravia, 1904. *Presented by the Publisher.*

The third part of this Prof. Costanzo Rinaudo's historical atlas for secondary schools includes the period from about the middle of the sixteenth century to the present time. There are altogether twenty-eight maps, twenty-four of which are devoted to Europe; one, on a small scale, to the Italian possession on the African Red Sea coast; one to the United States; and two of the whole world, showing European colonial possessions in 1789 and 1904. A complete index to place-names is given, as well as several pages of explanatory letterpress.

World. **Stieler.**

Neue, neunte Lieferungs—Ausgabe von Stielers Hand-Atlas. 100 Karten in Kupferstich. 35 and 36, Lieferung. Gotha: Justus Perthes. *Price 60 pf. each part.*

These two parts are in one cover, and contain the following maps: No. 8, German Empire. Scale 1 : 3,700,000; No. 43, Russia and Scandinavia. Scale 1 : 10,000,000; Nos. 51 and 52, sheets 1 and 2 of a map of the Balkan Peninsula on the scale of 1 : 1,500,000.

CHARTS.

Chile. **Chilian Hydrographic Office.**

Estrecho de Magallanes. No. 96, Puerto Zenteno, Canal Tortudso i Laguna Baja. No. 97, Canal i Puerto Condor i Lago de la Botella. Scale 1 : 20,000 or 3·2 inches to 1 stat. mile. Valparaiso: Oficina Hidrografica, Chile, 1903. *Presented by the Chilian Hydrographic Office.*

North Atlantic and Mediterranean. **Meteorological Office.**

Pilot Chart of the North Atlantic and Mediterranean for November, 1904. London: Meteorological Office, 1904. *Price 6d. Presented by the Meteorological Office, London.*

United States Charts. **United States Hydrographic Office.**

Pilot Charts of the North Atlantic Ocean and of the North Pacific Ocean for November, 1904. Washington: U.S. Hydrographic Office, 1904. *Presented by the U.S. Hydrographic Office.*

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

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